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American Foundryman

A PUBLICATION PRESENTING ASSOCIATION AND CHAPTER ACTIVITIES

Cleaning Out a Mold by Air Suction (See p. 13) *(Courtesy Continental Roll & Steel Foundry Co.)*

Record Attendance at Foundry Congress, See Page 2. The Open-Hearth Steel Furnace, See Page 4. High Temperature Properties of Cast Iron, See Page 8. Foreman Responsibilities, See Page 10. Instructions on Obtaining Metal for Patterns, See Page 12. Properties of Low-Tin Bronzes and Brasses, See Page 14.

May 1943

Malleable Iron Playing Vital Part in World War II

IN COMMON with other Divisions of the American Foundrymen's Association, during the past year the Malleable Iron Division has devoted all its effort to war production and its various problems. First in importance has been the supplying of high quality castings to our armed forces and secondly, the furnishing of trained technical assistance to make certain that the product is used to the best advantage.

Many new and interesting developments have occurred during the year in supplying our Army, Navy and Maritime Commission with malleable iron castings in place of strategic or other critical materials. These developments have helped in the more prompt completion of much equipment that otherwise would have been greatly delayed by the lack of material originally specified. In most cases the military engineers have been very receptive in recognizing the value of malleable iron and its possibilities.

Tough malleable iron castings with cored interiors have taken the place of forgings, with savings in metal, machine tool time and man-hours. A further contribution to this saving has been the ease and speed with which the metal can be machined. Many instances have been found where malleable iron castings can do the job just as well as other fabricated products. Hence the forge shop and other facilities have been conserved for uses for which they were essential.

In a number of instances machine tools and man-hours have again been saved, as well as valuable metal, by the use of cored malleable iron castings in place of machining parts from bar stock. Likewise, strategic copper has been saved by the use of malleable iron in gun mounts, aggregating as much as several hundred pounds in a single unit.

The large part played by the automotive industry in the production of armament has also assisted in intelligent use of malleable castings. Automotive engineers have long been familiar with the properties of malleable iron and have taken advantage of them in making certain that their machines and guns will be ready in large production quantities and on time. Pearlitic malleables have been used to excellent advantage where resistance to abrasive wear and greater strength and hardness were required, outstanding uses including cover plates for two-piece tank tracks, and in tank track rollers.

Thus, in 1942 Malleable Iron has played its part. This A.F.A. Division profited by the 1942 Foundry Congress, and again by the technical sessions at the 1943 Congress. By so doing we have better prepared ourselves for the rounding out of a year of even greater accomplishment in 1943.

A M Fulton

A. M. FULTON, Chairman,
A.F.A. Malleable Iron Division.

A. M. FULTON, *Superintendent of Northern Malleable Iron Co., St. Paul, and Chairman of the A.F.A. Malleable Division, has played an active part in the work of this Division for a number of years. He has served as chairman at several convention sessions on malleable iron problems, and is also most active in the work of the Malleable Founders' Society.*

American Foundryman

Contents

May, 1943

Vol. 5 — **Number 5**

	Page
Malleable Iron Playing Its Part in World War II, *by. A. M. Fulton*	Inside Front Cover
Record Attendance at St. Louis Congress Shows Intense War Production Interest	2
Principles of the Open-Hearth Melting Furnace in the Steel Industry, *by F. A. Melmoth*	4
High Temperature Properties of Cast Iron Discussed by A.F.A.-A.S.T.M.	8
War Production Awards in the Foundry Industry	9
Research Foundation Studies of Interest to the Foundry, *by L. Robert Oaks*	9
The Foundry Foreman's Responsibility in Making Personnel Work Effective, *by R. C. Kresge*	10
W.P.B. Issues Instructions on Obtaining Metal for Patterns	12
Milwaukee Selects Winners in Local Apprentice Contests	13
Report Correlates Properties of Low-Tin Content Bronzes and Brasses	14
New Members of A.F.A.	19
Government Orders of the Day for Industry	21
A.F.A. Chapter Officers	23
Chapter Activities	24
Abstracts of Current Foundry Literature	30
May Chapter Meeting Schedule	33

Published by the American Foundrymen's Association, Inc., 222 West Adams St., Chicago, Ill., for the purpose of presenting Association and Chapter activities. Published monthly. Subscription price, to members, \$1.00 per year; to non-members, \$1.50 per year. Single copies, 20c.

Entered as second class matter July 22, 1938, at the post office at Chicago, Illinois, under the Act of March 3, 1879.

Record Attendance at St. Louis Congress Shows Intense Interest in War Production

NO ONE who attended the 2nd War Production Foundry Congress in St. Louis, April 28-30, could help but be impressed by the evident intention of the Foundry Industry to meet the demand of our Armed Forces for more and better castings . . . on time. Total attendance far exceeded that at any A.F.A. Convention ever held in a non-exhibit year, and the tempo of interest in all sessions of this 3-day streamlined event was consistently high.

From the opening session Wednesday morning, until the last sessions Friday evening, the entire program emphasized the vital part that cast metals are playing in mechanized war. Practically every phase of foundry operations was covered, and the material presented will go far toward increasing the quantity and quality of cast war materials, and their prompt deliveries to the battlefields overseas.

The Job Remaining

The 1943 War Production Congress is now history, but before it can be called 100 per cent successful, one step remains . . . *using the information made available!*

Admittedly, the men who attended, the papers they presented and the discussions they held all added greatly to the fund of foundry knowledge. Their value to the foundry's war effort is limited only by the determination of the industry to make the fullest use of them.

Some of the papers presented at St. Louis have been preprinted and are still available. All papers, reports and discussions will be printed in the Quarterly *"Transactions"* compiled in Bound Volume form at the end of the year. In the event certain papers are wanted prior to publication in the Quarterly, A.F.A. will gladly make special arrangements to supply them.

Mr. Foundryman, your Association offers you, from the 1943 War Production Foundry Congress, a wealth of practical, vital data. This information, *tried and proven* by outstanding men of the industry, is yours for the asking. Today its full and immediate utilization is more than a matter of individual benefit *. . . it is essential to the Foundry Industry's maximum war effort!*

Materials Conservation

In view of priority regulations and shortages of critical materials, many foundrymen gave close attention to the presentation of data on conservation, use of substitute materials, downgrading and alternate specifications. In the Non-Ferrous field, recommended practices were presented for manganese bronze, aluminum bronze and silicon bronze.

A most important part of the Gray Iron program was the report on a survey of high-temperature properties and applications of gray cast iron, made by the War Metallurgical Committee of WPB with a committee of the A.F.A. Gray Iron Division cooperating. Refractories conservation, core sand reclamation, and the metallizing process as a pattern tool also were covered.

Molding and Coremaking

The wide variety of papers dealing with molding and coremaking practice included data on aluminum and magnesium, gray iron, steel, and brass and bronze, with the emphasis on shop practice and control. Sessions on aluminum and magnesium core and molding sands were especially well attended.

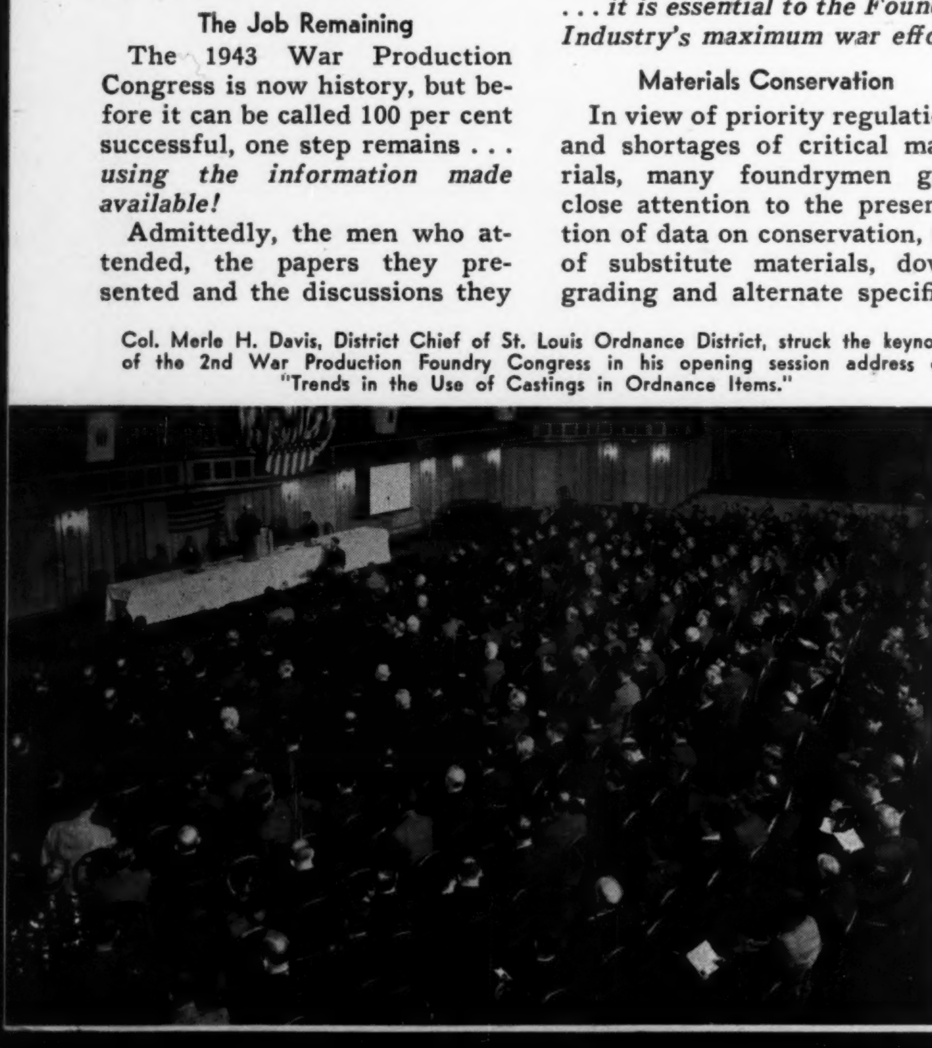
Gray iron sand control methods were stressed, and considerable attention given cement molding. Cores for steel castings, the use of bentonite, causes of burned-in sand, and a sand shop course session gave steel foundrymen much food for thought. Another paper dealt with centrifugal casting of brass and bronze.

Excellent data were offered all branches of the industry on core blowing methods, infra-red lamp drying of cores and molds, core sand reclamation, and elevated temperature studies of cores and coremaking materials.

Melting Methods

The all-important subject of melting methods was well covered at the Congress. Gray cast iron men found much of interest in papers and discussions on cupola combustion, slags, fluxes and desulphurizers, carbon control, front slagging of the cupola, refractories, and the shop control session on cupola operation. Steel melting papers included

Col. Merle H. Davis, District Chief of St. Louis Ordnance District, struck the keynote of the 2nd War Production Foundry Congress in his opening session address on "Trends in the Use of Castings in Ordnance Items."



information on converter steel, causes of gasiness, ductility factors, refractories, and the I.B.F. exchange paper on quantity production of manganese steel. Magnesium melting practice and aluminum ladle practice were among non-ferrous subjects.

This year the Malleable program concentrated largely on melting methods, completely covering modern melting practice. Papers were offered on air furnace-cupola duplexing, cupola-electric duplexing, cupola melting, open-hearth furnaces, and the Brackelsberg furnace, with emphasis on practical melting points. In addition, the comparative merits of pulverized coal and fuel oil as air furnace fuels were discussed.

Heading and Gating

A well-attended feature of this year's meeting was the series of lectures on heading and gating by W. G. Reichert, W. G. Reichert Engineering Co., New York. One lecture dealt with aluminum and magnesium, another with steel, a third with cast iron, with a great deal of valuable data offered at all three. In addition, discussion of atmospheric pressures in blind feed risers was continued from last year.

Training and Education

Few subjects have so concerned foundry executives recently as that of training available manpower. This year, in addition to meetings on foreman and apprentice training, emphasis was placed on wartime training methods. Demonstrations of the Job Methods Training and Job Relations Training were offered by the T.W.I. Division of the War Manpower Commission, and an entire session given over to discussion of training women for industry.

Apprentice training subjects included accelerated training of apprentices, and the second generation in apprenticeship work. Job evaluation and time study work were well covered. In the general field of foundry education, the problem of engineering education was considered at the dinner of foundry instructors in engineering schools, and an important paper embodying recommendations to castings buyers evoked comment.

Eager for data to help them in war production work, foundrymen register at Hotel Jefferson April 28. Total registered attendance at the Congress topped all previous records for A.F.A. annual meetings in non-exhibit years.

Engineering Properties

Working toward maximum utilization of cast materials in the war effort, papers on engineering usefulness of castings, especially in the gray iron field, were presented. Outstanding was the report of a survey on high-temperature properties of gray cast iron. The symposium on gray iron as an engineering material was especially valuable, one entire session dealing with such properties as modulus of elasticity, impact, endurance limits, vibration dampening, microstructure, compression and torsion, wear resistance, and strength and deflection.

On non-ferrous work, the paper on the effect of lead on the properties of manganese bronze was well received.

Inspection and Testing

The ever-increasing demand of Governmental agencies for the use of non-destructive methods of examination and testing castings was well illustrated at the St. Louis Congress. Methods discussed there included radiography and other non-destructive testing methods for steel, and fluoroscopic examination of "light metal" castings.

Heat Treating Methods

Papers presented this year on heat treatment of cast metals were confined entirely to gray iron and steel, insofar as specifically announced subject matter was concerned. However, heat treating practices and their effects on cast metals properties occupied noteworthy places in other papers as well.

Safety and Hygiene

One of the most important phases of foundry safety work today involves the magnesium foundries, and this subject was well handled at the safety and hygiene session. Papers dealing with magnesium covered fire prevention and control, health aspects of safety and hygiene work, and the mechanical exhaustion of fumes and smoke. In addition, a most interesting open question-and-answer period was offered on occupational disease problems of today.

Patternmaking

Problems associated with patternmaking under wartime conditions were discussed at the Congress, with papers and reports presented on job analysis and predetermining of time values for pattern shops, insurance protection, metallizing as a pattern tool, and pattern coatings.

Foundry Costs

A valuable feature of the foundry costs session was a round-table discussion where the principles for determining costs under Government contracts was explained. A number of misunderstandings were clarified by the panel leaders, members of the A.F.A. Cost Committee. Perhaps equally important was a report reviewing recommendations to buyers of castings.

Principles of the Open-Hearth Melting Furnace in the Steel Industry

By F. A. Melmoth,* Detroit, Mich.

The following paper was presented by the author, A.F.A. Medalist and widely known for his extensive work in steel castings, before one of the sessions of the Detroit Chapter lecture course, March 1942. The paper contains only a bare outline of the open-hearth melting process, being written primarily to present information of fundamental character for beginners in the foundry industry and students of metallurgy.

THE first patent on what is known as the regenerative open-hearth furnace was granted to Dr. C. W. Siemens and his brother in 1861. Such furnaces were originally used for glass manufacture, and it is believed the first ones used for steelmaking were built in Birmingham, England.

The regenerative principle is, of course, the very heart of the open-hearth steelmaking process, owing to the fact that the temperature of the fuel and combustion air being higher at the time of their reaction, the resulting heat production is of unusually great intensity, thus enabling the obtaining of furnace temperatures around 3,000° F. Such temperatures are necessary for the satisfactory melting and refinement of steel.

Basic Elements of Operation

Illustrations and diagrams of the Siemens open-hearth melting furnace have been published many times in previous literature. Development of the regenerative principle is by periodic reversal of the direction of input of fuel into the furnace. In the first direction, the fuel and air having passed through the combustion phase and afterward contributed a portion of their temperature to the furnace and the charge lying on the hearth, the gaseous products of consumption pass out of the furnace at the opposite end.

Carrying with them a portion of the heat produced by the combustion of the fuel—which may be oil, producer or natural gas or tar, suitably preheated—they then are led through chambers of refractory material, with inside passages so arranged as to expose large surfaces to absorb heat. Afterward, they pass to the atmosphere by way of the stack. These chambers are called checkers, doubtless due to the checkered design of their inner structure, and are essentially heat reservoirs.

If, now, after a due period of time, the direction of fuel input is reversed so that the flow through the furnace is in the opposite direction, the air to produce combustion is either drawn by stack draft or forced by fans through the chamber previously heated up by the waste gases, and thus arrives in the path of the fuel entering the furnace possessing a definite temperature of its own. This increases combustion efficiency, building up furnace temperature, and also passing gaseous products of combustion at a still higher temperature into the second of the checker chambers.

Checkers Are Heat Reservoirs

It will be seen that, assuming the periods of reversal are correctly controlled, the temperature of the individual checkers reaches a higher point at each reversal, and therefore is capable of passing on to the incoming combustion air a greater number of heat units. Each increase in the air temperature increases the intensity of fuel combustion, and very quickly steel melting temperatures are obtained in the furnace itself.

For our present purpose, this somewhat sketchy description of the principle upon which the open-hearth furnace is based will probably serve, and it is not proposed to go into detailed descriptions of the furnace construction. These are available in several books, notably one by Wm. C. Buell, Jr., entitled, "Open Hearth Furnace" (3 vols.), published by Penton Publishing Co., Cleveland. Interested students will find therein a complete clinical description of the most modern types of open-hearth furnace.

The hearth portion of the furnace, upon which the metal charge is melted, can be composed of either of two types of material, the one silica, in which case the process is acid in method, and the other magnesite or dolomite, necessitating a basic method of procedure. This will be dealt with further in considering the chemistry of the process.

The raw materials used are pig iron and steel scrap, proportioned according to the requirements of the steel to be made. The pig iron commonly varies from 10 to 20 per cent of the total charge, and contains approximately 3.5 per cent carbon, 1.5 to 2.0 per cent silicon, and 0.5 to 1.5 per cent manganese, with sulphur and phosphorus low enough to ensure the steel being to specifications, which usually range from 0.04 per cent to a maximum of 0.06 per cent.

Ferroalloys of silicon and manganese are used in the quantities necessary to deoxidize the steel and leave in it the elements of silicon and manganese in the specified amount.

Making Acid Mild Steel

The acid process being the more commonly used for steel casting purposes, a short account of the manufacture of a heat of acid mild steel for casting will probably be of interest.

The furnace bottom of pure silica sand, being thoroughly sintered into position, and the whole furnace at steel melting temperature, the pig iron portion of the charge is spread over the bottom and the steel scrap is charged above it. Handling of the charging pans in introducing

* Vice President, Detroit Steel Casting Co.

the material into the furnace is performed by a mechanical charging machine.

The physical nature of the scrap material controls to some extent the disposition of the charge, which is normally so arranged, in the opinion of the melter, as to give the best condition for rapid melting with the least amount of oxidation.

The proportion of pig iron used being low in present-day practice, adjustment of carbon can be made during charging by adding coal, crushed electrodes of the graphite type, or charcoal in the required amount.

Carbon Content of Bath

It is generally held that if the steel is to finish 0.25 to 0.30 per cent carbon, which is the common content for the general run of commercial mild steel castings, the carbon content of the bath at melting should be not less than 0.65 to 0.75 per cent. The reason for this will become evident in the later discussion of what is known as the "boil."

The flame being adjusted to the most efficient condition, the charge is now melted down as rapidly as possible, the direction of fuel input being reversed at regular intervals, usually 15 or 20 minutes.

When a good bath is obtained, it is usual to add judicious quan-

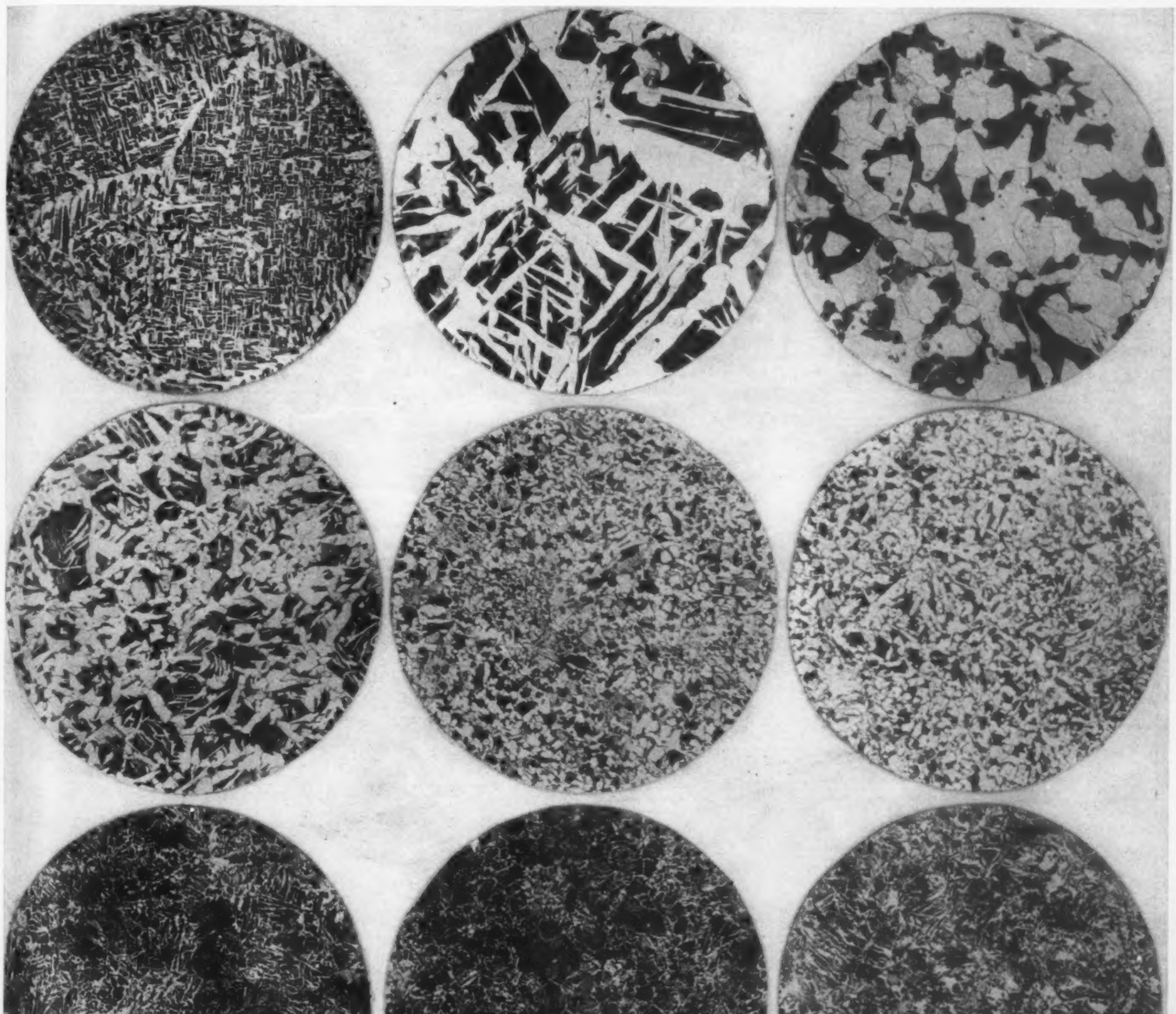


Fig. 1—Photomicrographs of cast open-hearth steel, following heat treatments indicated in Table 1. (References in parantheses, H.T.-A, H.T.-B, etc., refer to heat treatments shown in Table 1.) TOP ROW—Left, as cast (H.T.-A); Center, as cast (H.T.-A); Right, full annealed (H.T.-B). MIDDLE ROW—Left, normalized (H.T.-C); Center, double normalized (H.T.-D); Right, double normalized and drawn (H.T.-E). BOTTOM ROW—Left, normalized, water quenched and drawn at 1050°F. (H.T.-F); Center, normalized, water quenched and drawn at 1200°F. (H.T.-G); Right, air cooled, water quenched and drawn (H.T.-H). Magnifications: Top Row, Left 20X; all others 100X.

Table 1

Heat Treatment Schedule for Acid Open-Hearth Steel Castings

A	As cast. Allowed to cool in the sand mold to atmospheric temperature.	
B	2 hours at 1700°F cooled in the furnace to atmospheric temperature.	
C	2 hours at 1700°F	Air Cooled
D	2 hours at 1700°F 2 hours at 1500°F	Air Cooled Air Cooled
E	2 hours at 1700°F 2 hours at 1500°F 2 hours at 1200°F	Air Cooled Air Cooled Air Cooled
F	2 hours at 1700°F 2 hours at 1500°F 2 hours at 1050°F	Air Cooled Water Quenched Air Cooled
G	2 hours at 1700°F 2 hours at 1500°F 2 hours at 1200°F	Air Cooled Water Quenched Air Cooled
H	2 hours at 1700°F 2 hours at 1500°F 2 hours at 1300°F	Air Cooled Water Quenched Air Cooled

tities of sand to assist in producing the necessary volume of slag covering, and also to prevent the highly oxidized and hot, small thin slag produced during the melting from attacking the furnace banks. It must be remembered that iron oxide is a base, and at the temperatures used will satisfy itself at the expense of the acid silica bank of the furnace, if steps are not taken to prevent it.

Condition of "Boil"

When the charge is completely melted and all up from the bottom, which can be checked by the use of a rod or a rabble, the bath should be covered with an adequate layer of slag which, while of necessity high in iron oxide, is not too watery but of good consistency. Where rusty scrap is used, it is likely that at this point the bath will break into a more or less scattered boil, as the oxide of iron reacts with the carbon dissolved in the metal.

This term "boil" is used to describe the effect produced by the bubbles of carbon monoxide gas which, forming by the reaction of the oxide of iron and the carbon of the melted steel, escapes through the slag, producing bubbles on its surface with an appearance of boiling.

Assuming the bath to be at a high enough temperature, the refining or true steelmaking phase of the process can be commenced. If the scrap used is clean, it is likely that at this point the bath will be practically flat and tranquil, as it will contain a sufficient content of silicon and magnanese to protect the carbon from oxidation. This silicon and manganese must be oxidized and removed to the slag to permit of the necessary carbon reduction, which is achieved by the addition of solid oxygen in the form of iron ore, added in controlled quantities.

In a short time the surface of the slag will break into a more or less even, bubbling condition, previously referred to as the boil, indicating that the silicon and manganese have now been sufficiently reduced and the oxide of iron in the ore addition is reacting with the carbon, removing it as desired with the formation of carbon monoxide gas.

Avoiding Over-Oxidation

To avoid over-oxidation, a condition in the final stages detrimental to the production of high quality steel, only such amounts of ore must be added as will keep this reaction going at a regular controlled speed. Any excess over this produces a slag liable to cut deeply into the furnace bank at the slag line, and, in addition, produce a state of affairs at the end of the process difficult to correct.

It should be remembered that during this period, as during melting, the direction of operation of the furnace is regularly reversed, full advantage being taken of the recuperative principle as temperature builds up in the checkers.

The volume of fuel and the air pressure used need constant attention, and both can usually be reduced as the process proceeds, preventing the burning of the furnace itself, which can happen very easily during this stage. Samples of the metal are taken at intervals, cooled and broken for examination of fracture, and the trained and experienced melter from this can judge remarkably accurately the progress of the operation and, with a knowledgeable examination of the slag, govern his ore additions to achieve regular reactions with a minimum excess.

Final Ore Additions

As the carbon content approaches that desired in the finished steel, ore additions cease, and the reactions slow down until at the desired point they almost completely stop and the boil disappears or, at the most, becomes a matter of mere scattered, rather large bubbles. For the better qualities of acid steel, it is unusual to find conditions which allow of any ore addition being safely made in the final hour or so of the process.

The iron oxide content of the slag at this stage is falling, and it becomes appreciably thicker and more tenacious, which can easily be noted in the larger size of the bubbles now quite thinly scattered over the slag surface.

It should be mentioned at this point that many steelmakers use a percentage of lime in acid slag, usually amounting to from 4 to 8 per cent. This has the effect of thinning the slag and displacing a portion of its iron oxide content. Its use tends toward a workable and clean slag, finally low in active iron oxide.

Color of Slag Changes

During the oxidizing period of the boil, the color of the solidi-

Table 2

Effect of Heat Treatment on Acid Open-Hearth Carbon Steel Castings

Bar Number	Yield Point Lbs. □"	Ultimate Strength Lbs. □"	Elongation Per Cent in 2"	Reduction of Area Per Cent	Hardness: Brinell	Hardness: Shore Scleroscope	Charpy Impact Ft. Lbs.	Bend Test
1A	35,000	72,000	24.0	34.71	159	25	14.9	*135°
1B	42,000	72,000	29.0	49.18	149	24	19.6	180°
1C	45,500	78,500	24.0	35.67	170	26	27.5	180°
1D	44,500	76,500	30.0	48.00	163	25	30.5	180°
1E	43,250	73,750	34.0	58.83	149	24	30.4	180°
1F	61,500	90,000	25.0	52.50	207	32	27.5	180°
1G	55,000	80,750	26.5	58.32	174	27	34.3	180°
1H	47,250	72,500	32.5	66.32	156	25	41.3	180°

Number denotes analytical series.

Letter: Refer to heat treatment schedule.

Analysis: Carbon, 0.26%; Manganese, 0.70%; Silicon, 0.31%; Phosphorus, 0.036%, Sulphur, 0.036%; Chromium, 0.29%; Nickel, 0.27%.

*Broke

fied sample of the slag is dark brown and often nearly black; but toward the final stages, as iron oxide content lowers, particularly in the presence of a suitable lime content, this color becomes green. Often at the very end of the process it is a clear apple green.

The carbon now being down to the desired point, and samples indicating a satisfactory temperature, the heat is ready for finishing. Being low in carbon, and with mere traces of the deoxidizing elements (silicon and manganese), the metal itself has dissolved quantities of iron oxide and if poured would be wild and gassy, and after solidification permeated with holes.

It is necessary, therefore, to remove the bulk of this dissolved oxide, and this is done by correctly proportioned addition, first, of ferrosilicon, and then, a little later, ferromanganese. The quantities used are so calculated as to produce soundness by bringing about what is known as killing the steel, and also to leave behind as constituents of the steel itself the specified content of each element to produce the ultimate physical properties desired.

The deoxidizing additions being thoroughly incorporated, by the necessary time and the help of a thorough stirring, the taphole is opened and the steel allowed to run into a previously heated ladle, from which it is poured into the molds.

Some Theoretical Considerations

The acid process — that is, melting and finishing operations carried out on an acid or silica-lined hearth—is not capable of removing either sulphur or phosphorus. The raw materials, pig iron and steel scrap, therefore, should be selected with care to insure final content of these impurities being low enough to meet any specifications which may be involved.

The pig iron used will possess normally about 3.5 per cent carbon, 1.5 to 2.0 per cent silicon and 0.5 to 1.5 per cent manganese. With the general run of commercial steel scrap in reasonably good condition, that is, not extremely heavily rusted, this will result in a bath at melting high enough in carbon to support a satisfactory boil, and with the silicon and manganese content not so high as to occasion loss of time by delaying the boil.

Should the carbon content of the bath be too low, either because of too small a proportion of pig or because of excessive oxidation in the melting period, not only would the boil period be too short, but the slag inevitably would be very highly oxidized, and the oxidation procedure more or less out of control.

Controlling Boil Essential

As previously pointed out, the manganese and silicon of the bath are first oxidized, and as they become practically traces, the oxidation of the carbon by the iron oxide of the ore addition produces carbon monoxide gas which, rising in bubbles through the slag layer, produces the boil. The control of this boil represents the essential of the steelmaking process. It has a physical action, tending toward the production of cleaner steel, and modern thought credits it also with the elimination of hydrogen, which, if allowed to remain, is believed to exert a very malign influence upon casting quality.

It should always be remembered that any serious excess of oxide over and above that required to remove by the boil the desired amount of carbon, means that the process enters its final stages in a highly oxidized condition. Apart from possible effect upon quality, such a condition will prove wasteful in expensive deoxidizing alloys such as ferrosilicon and ferromanganese, and there is a distinct possibility of dirty steel as a result of the excessive production of non-metallic oxides at this point.

A typical finishing slag contains about 12 to 15 per cent iron oxide, and the silica content will reach as high as 60 to 65 per cent.

Ferromanganese additions should allow approximately 35 per cent of loss of metallic manganese over the amount specified to remain in the steel. This loss, of course, results directly from the oxidation of the manganese by excessive dissolved iron oxide and the manganese oxide normally passes to the slag.

Properties for Castings

The open-hearth process is capable of handling satisfactorily most of the low alloy classes of steel commonly used in casting form, as well as the whole range of carbon steel. If properly handled, the resulting quality is remarkably high, and the steel also behaves well in the foundry from the casting point of view.

The furnaces being of almost any size, from 5 tons to upward of 150 tons individual capacity, it is the process above all adapted to heavy production schemes, or heavy individual castings. It is not as convenient for small castings as the electric or converter processes, as the temperatures normally attained in the finished metal are not so high, and the difficulties of disposal in small castings of such large quantities of molten steel involve too much time for the large unit charges of the open-hearth furnace.

It is of extreme importance to steel foundries that the steel from which its castings are made responds easily to heat treatment. It has to be remembered that no mechanical work of any description which can affect the structure of the material is performed upon castings at any time, and therefore no breaking down of the as-cast crystalline structure takes place apart from what can be accomplished by direct heat treatment.

The open-hearth furnace produces steels which in ordinary conditions respond very well to heat treatment, the resulting material being able to meet any of the presently issued specifications of either Government departments or inspection authorities.

Fig. 1 and Tables 1 and 2 illustrate a few of the available properties in various conditions of heat treatment, and attempt to show the associated microstructure, both in the cast and heat treated condition.

High Temp. Properties of Cast Iron Discussed by A.F.A.-A.S.T.M.

A PRELIMINARY report of the meeting of A.S.T.M. Committee A-3, Subcommittee on Elevated Temperature Properties of Cast Iron, held in Buffalo, N. Y., March 2, at the time of the midyear A.S.T.M. committee meetings, recently was received from J. S. Vanick, International Nickel Co., New York, chairman of the subcommittee. In addition to the personnel of the subcommittee mentioned, members of the A.F.A. Gray Iron Division Committee on High Temperature Properties of Cast Iron had been invited to attend. Some 30 to 40 representatives of all groups were present, Chairman Vanick presiding.

In opening the meeting, Chairman Vanick discussed the origin of the committee, which was formed by resolution passed at the June, 1942, Annual A.S.T.M. meeting, and the events that followed, leading up to cooperation from the American Foundrymen's Association. Simultaneously, the interest of the Government in utilizing the productive capacity of the foundry industry for making cast iron equipment, led to a study of the subject by the War Metallurgical Committee, with the A.F.A. Gray Iron Division Committee on High Temperature Properties of Cast Iron acting in an advisory capacity.

The main feature of the meeting centered about a discussion of the assembled opinion of representatives of various manufacturing interests who employ cast iron at elevated temperatures, and a preliminary report upon the findings of the War Metallurgical Committee. The report classified its findings into four temperature ranges covering applications from:

450° to 600°F.—Pressure Vessels
600° to 750°F.—Pressure Vessels
750° to 1000°F.—Engine and Firebox Castings
Over 1000°F.—Engine and Firebox Castings

The discussion revealed that the application of cast iron to pressure vessels had not been surveyed since 1914, and at that time cast iron with a tensile strength of 20,000 p.s.i. was considered of good quality. The 1914 survey revealed that no trouble had been experienced in pressure applications operating under 450°F. and 150 lb. pressure, and these limits were naturally accepted. The comments at the time indicated that if a 30,000 lb. iron had been available, higher temperatures and pressures would have been allowed.

Since that time, the strength of cast iron has been more than doubled. The War Metallurgical Committee's report revealed that many pressure applications operate successfully at temperatures above 450°F. They also revealed that in the higher temperature ranges cast irons are correspondingly high quality types, and more than 50 per cent of that represented processed or inoculated cast irons of the latest metallurgical high grade types.

Representatives of various industrial groups at the Buffalo meeting expressed the opinion of their industries regarding the properties and performance of cast iron under the conditions which their equipment encounters in service. There were comments concerning design factors which limited manufacture in the foundry to specific types of castings; other comments concerning the over-design of parts such as valve castings, which might be readjusted by dividing designs into large and small diameter members.

Further comments were made on stress concentration in pressure castings and upon heat transfer in direct fired vessels which were under little or no pressure.

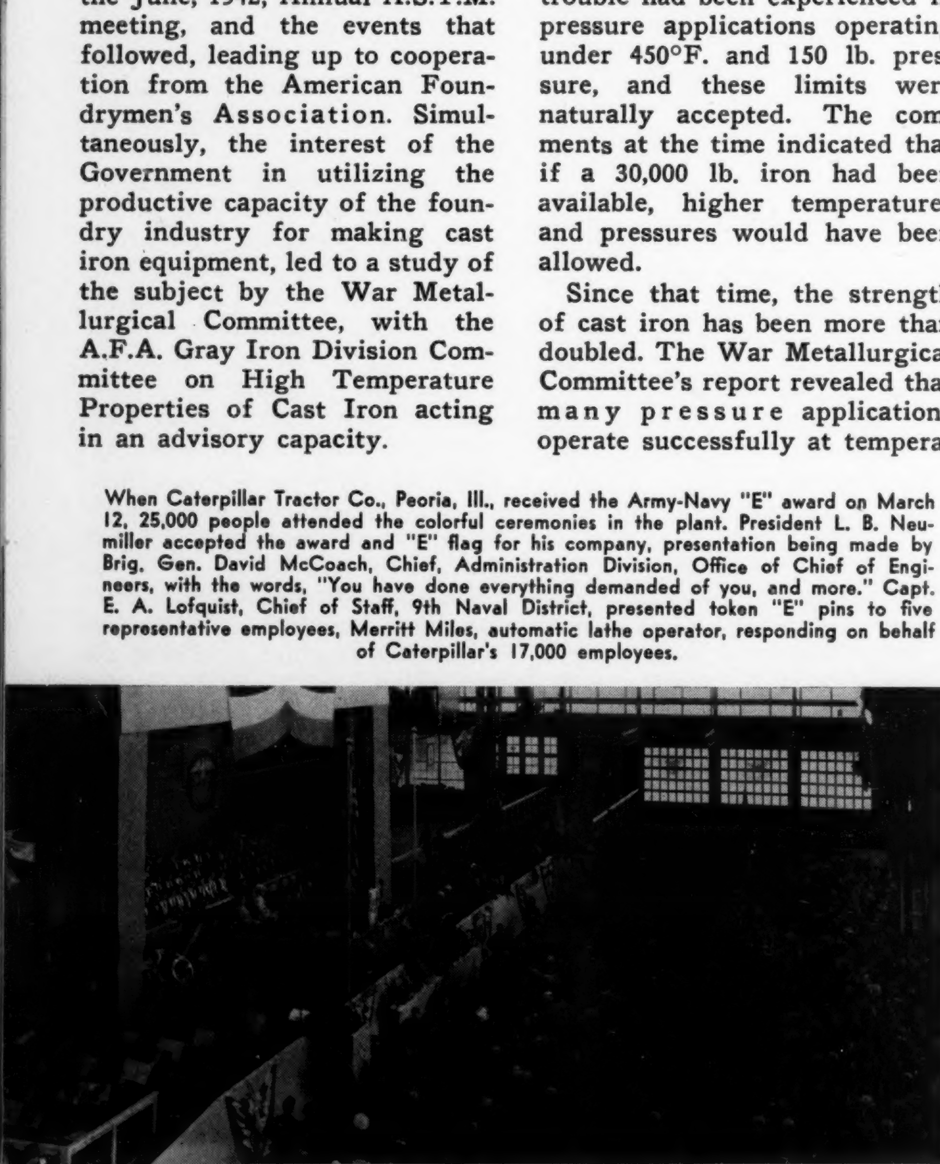
Information Wanted on Foreign Lands

The Associated Defense Committees of Chicago Technical Societies have issued an urgent request for the names and addresses of all engineers or scientists who have technical information concerning industries, communications, transportation, raw materials, etc., of continental Europe, the Scandinavian countries or any of the Japanese occupied territories. The Committee also is looking for moving pictures or still pictures showing coast lines, harbors, industrial centers and the like of such countries.

Any person having such information or knowing of someone who has such information, please communicate at once with Robert C. Brown, Jr., Chairman of Associated Defense Committees, 53 W. Jackson Blvd., Chicago. Give as much detail as possible concerning the type of information that is available.

Here is a real way to help the war effort, so do it now!

When Caterpillar Tractor Co., Peoria, Ill., received the Army-Navy "E" award on March 12, 25,000 people attended the colorful ceremonies in the plant. President L. B. Neumiller accepted the award and "E" flag for his company, presentation being made by Brig. Gen. David McCoach, Chief, Administration Division, Office of Chief of Engineers, with the words, "You have done everything demanded of you, and more." Capt. E. A. Lofquist, Chief of Staff, 9th Naval District, presented token "E" pins to five representative employees, Merritt Miles, automatic lathe operator, responding on behalf of Caterpillar's 17,000 employees.



War Production Awards in Foundry Industry

American Cast Iron Pipe Co., Birmingham, Ala., was presented with the Army-Navy "E" flag on March 24 for efforts in production of war materials.

American Foundry Equipment Co., Mishawaka, Ind., was notified on March 20 that they have been awarded the Army-Navy "E" for excellence in war production.

Desmond-Stephan Mfg. Co., Urbana, Ohio—Army-Navy "E" award.

Fort Pitt Steel Casting Co., McKeesport, Pa., recently received the "M" award from the Maritime Commission.

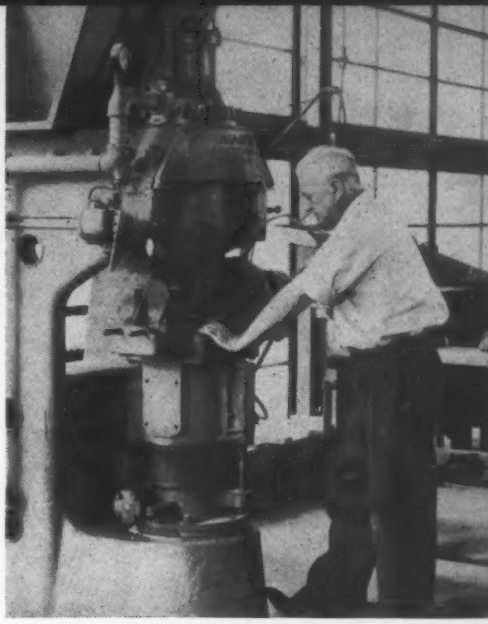
Mathieson Alkali Works, Niagara Falls Plant, Niagara Falls, N. Y.—Army-Navy "E" award.

Kensington Steel Co., Chicago —Army-Navy "E" award.

McCallum-Hatch Bronze Co., Inc., Buffalo, N. Y., received the Army-Navy "E" flag at ceremonies held February 23.

Pangborn Corporation, Hagerstown, Md., received the Army-Navy "E" on April 20 at appropriate plant ceremonies.

Whiting Corporation, Harvey, Ill.—Army-Navy "E" award.



Operating a core blowing machine in the sand laboratory of Armour Research Foundation's experimental foundry, in a new building devoted to metals and minerals research.

Research Foundation Studies Of Interest to the Foundry

By L. Robert Oaks,* Chicago, Ill.

THE Armour Research Foundation of Illinois Institute of Technology, Chicago, recently dedicated its New Metals and Minerals Research Building. This building is of very modern design with excellent lighting facilities and is exceptionally well equipped for facilitating research in many fields related to the foundry industry.

Among the numerous researches being conducted are studies on the casting of steel, a project now in its second year. New binders for foundry cores also are being investigated, the binders being subjected to practical tests in the foundry. This study is a part of a larger research program devoted to the discovery of new and improved methods for metal processing and manufacturing.

Among the projects also of direct interest to the foundry industry are those on dolomite and the mineralogy of basic open-hearth slags, this project on dolomite having been continued into its fifth year. The mineralogy of the basic, open-hearth slags also is being further investigated by petrographic and x-ray methods. These investigations are concerned with identification and composition of the crystal phases in slags.

Considerable work is being done at Armour Research Foundation in the field of testing materials. This work, which includes the testing of foundry products, constitutes a sizeable portion of the Foundation's studies. The materials testing laboratory has tested a great variety of materials for strength besides the usual tension, bending, hardness, and compression tests. A fundamental study of the action of material in resisting dynamic loads is proceeding, and during the past year, a complete photoelastic laboratory has been added equipped for three-dimensional analysis by the freezing method.

Corrosion studies are continued from previous years. A corrosion machine designed and built by the Foundation was used to establish severe and accelerated corrosion conditions. Studies were conducted in connection with automotive cooling systems, structures exposed to highly corrosive atmosphere, and bearings operating under similar conditions. Studies of cavitation erosion of metals produced by magnetostriction have been related to steam erosion, developing much data on the effectiveness of various oils in protecting metals from erosion.

*Asst. to the Director, Armour Research Foundation.

Melting equipment at the new Metals and Minerals Building of Armour Research Foundation includes an induction furnace for steel research.

The Foundry Foreman's Responsibility in Making Personnel Work Effective

By R. C. Kresge, Chicago, Ill.

The author, who is personnel director, Link-Belt Co., Chicago, Ill., presented this paper before the Northern Illinois-Southern Wisconsin chapter. He reviews the policies and principles governing the different departments and operations in his plant. He discusses practical industrial management and what it does for their plant. He lists ten policies affecting employees and explains why it is the foreman's job to see they are properly explained to all employees. In conclusion the author comments on a few topics that he believes should be included in a course for companies contemplating a foreman training course.

THERE are any number of books on the market today telling all about a foreman's responsibility. A list of do's and don'ts can be handed a foreman, and management assumes that their job is done. Their job certainly is not done, they have merely started something that might lead to chaos and labor trouble.

In passing, let us briefly review the policies and principles governing our different departments and operations. It is easy to list the matters on which you could define principles and policies, but to fit them in all cases is difficult. One of the most important subjects as discussed today is the matter of wages. How are you to set your wages, pay each man for the job he is doing? How shall you differentiate? What is the relation of your wage scale to those paid in your certain area or community? What recognition is given for skill, effort, working conditions and responsibility?

Wage Determination

The techniques of wage determination are being given more consideration by management every day. The aggressive management as of today is including in their policies and principles operating standards, standardization, job analysis, job rating, merit or employee rating and personnel relations.

In our type of plant those principles described above have been worked out very successfully. Ours is not a production plant, it is an engineering plant that operates an iron and steel foundry, machine shop, structural steel shop, assembly shop and the necessary auxiliary departments that make up a manufacturing unit.

Years ago we began to learn the expression and term "scientific management." It is a nice phrase to use, and sounds good, but a definition for scientific management has never been found.

Practical Industrial Management

The phrase "practical industrial management" gives you a better idea what this production control, job evaluation and employee rating is all about. We all like to be applying knowledge to some useful end. How can this knowledge be applied? It can be applied by following certain fundamental principles. Looking up the definition for fundamental, Webster tells us: "That which serves as a foundation." Laying the ground work, that is absolutely necessary in order to establish all the principles of practical industrial management.

As an example, you hire a coremaker and pay him seventy cents an hour. He has been given instructions to make a certain set of cores; first, we find him going to the pattern storage and searching for boxes, transporting boxes to bench, searching and selecting the proper plates, searching for or borrowing pliers, searching for a roll of wire, ramming and drawing the boxes, transporting the cores to the core oven, forty feet away, and then returns the transport empty. The majority of shops most certainly do not make cores that way. If they do they will find that their cores for that particular job are costing fifty or sixty cents a set.

So what does practical industrial management do? It sets up fundamental principles, lays the ground work, plans procedure, controls conditions, and sets up operating standards. Instead of the coremaker wasting his time and the company's money, the core box is on his bench, the plates are at his side, the wires are cut to size in a bin within reach, and a core rack is within three feet of his bench instead of having the core oven forty feet away. Many are not familiar with such words as search, select, transport empty, transport loaded, these are motions that the late Dr. Gilbreth had the honor of discovering and are called "therbligs," Dr. Gilbreth's name spelled backwards.

Having eliminated these "therbligs," through fundamental principles, the cores cost twenty-five cents a set instead of sixty. You can go a step further, if the quantity is great enough, by ganging the boxes and placing them on a machine, again making a study of motion economy. It also may be possible to use a man of lesser skill, still reducing the cost of your core set.

Watch Your Overhead

The question may arise what's the difference who does it? In our shop it raises overhead. Perhaps one of the best indications of the efficiency of an operation is to look at the overhead and see it high. You know if your direct labor is broad, your indirect is narrow and vice versa. Our plant is still inter-

ested in the cost of a unit casting delivered from the foundry.

From experience it has been found that the measurement of productive effort is a good thing to have. The common denominator of productive effort is money, and a given amount of productive effort, measured in terms of money, is a wage incentive system. A wage incentive system may only be as good as the honesty and fairness of the management directing it and the men participating in it. What is meant by that? Establish proper operating standards, control these standards, measure productive effort, equitably pay for productive effort, absolutely guarantee the rate standard under existing conditions and give the men a proper understanding what your rate structure is about.

Rate Structures and Incentives

The question asked most often is how do you arrive at your rate structure and your incentives? Our answer is job rating or job evaluation. Labor as an element of productive effort must have jobs, and these jobs must be measured or evaluated. What we are trying to obtain is a fair amount of work for a fair day's pay, and that is the background for all of our evaluation work. We evaluate jobs, and there are at least four or five good methods of evaluation. They all work out well, but our plant has selected one and found it to be successful. The wage rate for each job or operation should be determined relatively with other jobs in the plant, with due regard for differences in skill, experience, effort, responsibility and working conditions.

If one is to exist in business, one must develop job evaluation. Many are in business to stay in business and in order to stay in business one must make a few dollars profit. If your line of wage rates are higher than your competitor, you have two alternatives, one is to go out of business and the other is to pick up the slack through method engineering or operating efficiencies. In a broad proposition the general wage level in the plant

The chapter lecture courses cover many subjects directly related to foremen and supervisory positions.

should at least be equal to the going wage level for comparable jobs in the community.

The benefits derived from job rating are the relationship between jobs departmentally and inter-departmentally. Avoid inequitable differences in wage levels between departments for comparable work, establish definite factors upon which occupational wages can be based under payment of jobs in relation to each other, adjustment of wages out of line, an accurate comparison of new jobs and personnel relations.

Raises and Promotions

It is easy to raise a man from seventy cents to seventy-five cents an hour after he has made good during his probationary period. The question then is when is a man entitled to more money or a raise. Our evaluation department knows that a particular job will pay as high as eighty-five cents per hour. They have solved that by merit or employee rating. An easy way of describing employee rating is the application of descriptive adjectives to a man's personal characteristics. This is not only a means of determining when an employee is entitled to a raise, but a means of selecting men for supervisors or more responsible positions.

The foundry foreman's responsibilities have been made lighter, if management has taken care of the main items as described in this article. Of course, the foundry foreman has other responsibilities. How well does he discipline employees who deserve it? Does he "bawl" them out in front of everybody? Does he use sarcasm so others can hear? Is he blunt, but takes employees aside? Does he try to be helpful and considerate? Are his criticisms usually helpful and always given in private?

The above could be given out as a questionnaire to the employees. Maybe we would find out something about our foreman.

Another very important item that is management's responsibility is a written copy of the company's rules and policies. A copy should be given each new employee, instructing him to read and contact his foreman on any item that he does not understand. It is the foreman's duty to know all of the policies and regulations and see that they are all enforced. Here are some of the policies affecting employees: wage policies, up grading, safety regulations, vacation policies, beneficial and group insurance plans, working hours, grievance procedure, labor agreement if unionized, grounds for discharge and miscellaneous rules for conduct on job.

Ten Important Policies

These ten rules or policies are important. There is one in particular that is worthy of extra comment and that is grievance procedure. Every employee's grievance carries a large red label, "Dynamite, handle with care." When a grievance is not adjusted, either because management does not know about it, or knowing, does nothing, three things happen: The aggrieved employee's attitude hardens, he becomes more difficult to deal with; other employees champion the grievance and discontent spreads; and if a union is in-

volved, settlement favorable to the employee becomes a matter of union prestige.

Grievances can be avoided by: Not resenting, getting facts, being patient, stating facts, settling quickly and eliminating cause of grievance.

There are ten major fundamentals of good foundry supervision that a shop should stress if they are contemplating a foremanship training course for their foremen. The following items would furnish the necessary topics: Handling people, controlling waste, eliminating waste, maintaining quality standards, preventing accidents, developing co-operative organization relations, training and instruction, applying practical job psychology, improving methods and steady self-improvement.

W.P.B. Issues Instructions on Obtaining Metal for Patterns

THOMAS KAVENY, JR., Chief, Foundry Equipment and Supplies Section, Tools Division, War Production Board, has released the following information in regard to obtaining aluminum pattern equipment under the Control Materials Plan (C.M.P.). This communication interprets "pattern equipment" as meaning match plates, patterns, core boxes, core dryers, and snap flasks, but does not include jigs, fixtures or forming blocks. In the instructions given in the release, the word "pattern" refers to "pattern equipment." The release reads as follows:

"Patterns are a B product under CMP. Aluminum castings for patterns (except when they are made from old pattern equipment furnished by the prospective user of the new patterns) are obtained pursuant to CMP Regulation No. 1, not CMP Regulation No. 5 dealing with maintenance, repair, and operating supplies. However, the finished patterns are also operating supplies and orders for them may be given the preference ratings specified in CMP Regulation No. 5. Delivery of aluminum castings made from old pattern equipment furnished by the prospective user of the patterns is not subject to any CMP Regulation.

"Under the terms of paragraph (c) (4) (v) of Order M-l-i, aluminum is permitted for patterns under certain conditions.

"The following procedure for obtaining aluminum patterns applies, whether or not the foundry making the pattern castings is a "captive" foundry or the pattern shop is part of the foundry.

"(a) When the pattern user does not supply obsolete or defective patterns from which to make new patterns:

"1. Unless the use of the pattern is essential to the fulfillment of quantity production of authorized controlled materials orders or of other quantity production orders bearing priority rating AA-2X or higher, aluminum may not be used without specific authorization pursuant to paragraph (d) of Order M-l-i.

"2. The user of the patterns extends the preference rating (specified for him by paragraph (d) of CMP Regulation 5), to the pattern maker.

"3. The pattern maker files Form CMP-4B with the Tools Division, WPB, for an allotment of aluminum pattern castings. When he receives the allotment, he serves it on his supplying foundry. Any aluminum foundry may fill orders bearing CMP allotment numbers."

On receipt of the release, a prominent manufacturer of aluminum patterns and match-plates analyzed the situation as follows:

"Beginning May 1, no foundry can accept orders for aluminum match-plates or pattern castings, except by one of the following methods:

"1. The company ordering the pattern must supply an amount of scrap or obsolete aluminum pattern equipment equal to the weight of the new castings. No CMP authority or priority is necessary when scrap or obsolete aluminum patterns are furnished.

"2. The order for aluminum pattern equipment must be certified to by CMP Regulation No. 7 stamp and bear a rating of AA-2x or higher and also must show the buyer's allotment number. This allotment number is not the one under which production castings will be made."

Starting May 1, under CMP, it will be necessary for all buyers of aluminum pattern equipment or those obtaining aluminum pattern castings from their own foundry, to secure an allotment number for aluminum pattern castings by completing form CMP-4B for the second quarter. This requirement includes pattern jobbers, foundries, and manufacturers, even though they have their own pattern shops and/or aluminum foundries.

For a buyer to obtain his allotment number, he must file immediately three copies of Form CMP-4B. Copies of this form, together with instructions, are obtainable from local War Production Board offices. The producer of aluminum match-plates and patterns suggests the following as an aid to filling out these forms and pressing WPB for immediate action:

In the space headed "Product to be made by applicant as listed in CMP Class Product List," the buyers should insert "Foundry Machinery, Equipment and Supplies."

In the space headed "Applicants own description of product," the word "Patterns" should be inserted.

Section A of the form must be filled out for 12 months, starting April, 1943, and including March, 1944. This is an estimation of the number of jobs to be made and the dollar value of them.

Section C, Part 6, under Aluminum Castings, an estimate of the number of pounds of aluminum castings needed must be given.

Sections D and E, Columns 2 and 3 in both these sections will be identical and the division in Section D should be according

to the records of the purchaser, irrespective of whether he be a pattern jobber, a foundry or a manufacturer which has his own pattern shops and/or aluminum foundries. However, in Section E, the total dollar value will be carried in Column 10 only because patterns are used entirely in foundries and are considered "civilian supplies."

Similar CMP-4B forms for the third quarter are now available and these also should be filled out promptly to insure your supply of metal for that particular period.

The above analysis of the situation regarding aluminum for pattern equipment is published in the hope that it will be of aid to pattern makers in securing their necessary aluminum requirements.

Bur. of Mines Issues Coal Storage Circular

AN INFORMATIVE circular on "The Storage of Coal" is being issued by the U. S. Bureau of Mines, containing useful technical information to help consumers protect coal storage piles from degradation and spontaneous combustion. The circular, prepared by J. F. Barkley, Chief of Division of Solid Fuels Utilization for War, answers a large number of questions arising in connection with wartime coal storage problems and is issued in the interest of wartime fuel security.

Copies may be obtained by writing the Bureau of Mines, U. S. Dept. of Interior, Office of Solid Fuels Coordinator for War, Washington, D. C.

(Courtesy John Bing, A. P. Green Fire Brick Co.)

C. E. Westover, Association Executive Vice President, and W. A. Hambley, Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin Regional Conference Chairman, talk it over.

Milwaukee Selects Winners in Local Apprentice Contests

WINNERS of the local apprentice contests were announced recently by the Wisconsin Chapter of A.F.A., preliminary to the national apprenticeship contests conducted annually by American Foundrymen's Association. Winning entries were selected in the gray iron, steel, non-ferrous and patternmaking groups, the contests being held with the cooperation of the Milwaukee Vocational School.

Castings and patterns made by those ranking highest in each group were displayed and judged at the A.F.A. Foundry Congress held in St. Louis on April 28-30. That Milwaukee's younger generation is enthusiastically behind the war effort is shown by the great interest displayed in the local contests.

Local Contest Judges

Judges of the local contests were made up of a committee of foundrymen including C. W. Morisette, Chairman, and J. Van Kooy, both of Milwaukee Vocational School; G. A. Zabel, Universal Foundry Co., Oshkosh, Wis.; T. E. Ward, Badger Malleable & Mfg. Co., South Milwaukee; E. P. Meyer, Chain Belt Co., Milwaukee; A. H. Schott, Standard Brass Works, Milwaukee; R. Riedel, Production Pattern Co., Milwaukee; H. Warner, Allis-Chalmers Mfg. Co., Milwaukee; Oscar E. Woehlke, Spring City Fdy. Div., Grede Foundries Inc., Waukesha, Wis.; O. T. Nelson, Industrial Commission of Wisconsin, Madison, Wis.; J. McGill, and L. Bartell.

Patterns were made at the Milwaukee Vocational School under supervision of J. Van Kooy and taken to foundries with enrolled apprentices, where the apprentices were required to make castings from them. Winners were selected after the judging committee inspected the castings thus made. Considerable interest was displayed by several of the city's largest foundry plants.

Winning Apprentices Named

Winners in the various group contests are as follows:

GRAY IRON—1st place, Fred Bartel; 2nd, Alphonse Terek; 3d, Jerome Lauman, all of Allis-Chalmers Mfg. Co. Other winners, in order of rank: George Allen, Vilter Mfg. Co.; Robert Speerbrecker, Allis-Chalmers Mfg. Co.; Marvin Simmons, Nordberg Mfg. Co., Milwaukee; Russell Knaack, Vilter Mfg. Co.; Alvin Lovas, Allis-Chalmers; George Elleseq, Vilter Mfg. Co.; Roland Kurth, Nordberg Mfg. Co.; Carl Zabel and Carlo Tarantino, C.M.St.P. & P. Ry. foundry; Joseph Pheiffer, Nordberg Mfg. Co.; Robert Walford, C.M.St.P. & P.

STEEL—1st place, John Nowak, Maynard Electric Steel Casting Co., West Allis, Wis.; 2nd, Frank Chevonec, Falk Corporation, Milwaukee; 3d, Arthur Tazalla, Maynard Electric Steel; 4th, Edward Erchell, Falk Corp.; 5th, Roy Wasielewski, Maynard Electric Steel

NON-FERROUS—1st place, Ferdinand Sevenz, Ampco Metal, Inc., Milwaukee; 2nd, Tony Ivanotich, Standard Brass Works; 3d, Otis Wilson, Nordberg Mfg. Co.; 4th, Jerome Lauman, and 5th, Alvin Lovas, Allis-Chalmers.

PATTERNMAKING — 1st place, R. Satorius, Falk Corp.; 2nd, P. Huschbroeck, R. Symonia 3d, B. Peschel 4th, and E. Kulinski 5th, all of Allis-Chalmers; 6th, A. Behr, Bucyrus Erie Co., So. Milwaukee.

Milwaukee district foundries have long been among the most active in the A.F.A. apprentice contests, the city's industries playing a leading part in apprenticeship training. Last year the Wisconsin Chapter, Northeastern Ohio Chapter, Quad City Chapter and St. Louis District Chapter sponsored local contests preliminary to the national A.F.A. competitions, in which Wisconsin entries captured 2 first, 2 second and 2 third prizes.

Vacuum Cleaning Molds

DEEP and intricate molds are effectively cleaned with vacuum nozzles at Continental Roll & Steel Foundry Co., East Chicago, Ind., as shown in the photo on the front cover. A special lance nozzle is used to reach recesses and remove dust, sand and foreign matter quickly and economically.

Report Correlates Properties of Low-Tin Content Bronzes and Brasses

THE Non-Ferrous Subcommittee of the Technical Committee, the Institute of British Foundrymen, has issued a report of the War Emergency Specifications drawn up by the British Standards Association. The purpose of these specifications is to conserve tin by substituting lower tin content alloys for the 88-10-2 alloys. In addition, two alloys, designated as cast brass Types A and B, have been recommended.

As there is considerable similarity between the British and American emergency specifications, the latter issued by the American Society for Testing Materials as Emergency Provisions, the information contained in the British report dealing with the properties of these alloys should be of interest to foundrymen manufacturing brass and bronze castings. The summary of properties was compiled by F. Hudson for the group.

The alloys recommended by the British Standards Institution for substitution for the 88-10-2 alloys are 88-8-4, 86-7-5-2 and 85-5-5-5. The compositions, including those of the two brasses, are shown in Table 1. The A.S.T.M. specifications to which the substitute alloys approximately correspond are shown at the top of next column.

Alloy Designation	*A.S.T.M. Specification Number*
88-10-2	Alloy 1A, B143
88-8-4	Alloy 2Y, EA B143
86-7-5-2	Alloy 2, B143*
85-5-5-5	Alloy 5X, EA B145
Type A Brass	Alloy 6X, EA B146
Type B Brass	Alloy 6Y, EA 146

*Listed as substitute for Alloys 1A and 1B, A.S.T.M. specification B143.

The forepart of the compilation of properties brings out that it is not always possible to entirely eliminate the higher tin content alloys from engineering applications. For certain special purposes their use appears to be essential. For example, it has been shown[1] that in unlined bearings subject to pounding, such as employed for railway car bearings and rudder bushes, etc., on ships, the resistance to deformation is markedly reduced as the tin content falls below 10 per cent and with the introduction of lead.

It is interesting to note that the presence of up to 4 per cent zinc has in most instances but little effect upon frictional properties and resistance to deformation.[2] The use of gun metal or bronze containing around 10 per cent tin is also considered essential for the production of high-pressure air and hydraulic valves operating at 1,000 to 4,000 lbs. per sq. in. Alloys containing up to as much as 12.5 per cent tin have been unnecessarily specified for these latter applications in the past, the higher tin content making the production of sound castings more difficult in the foundry.

On the other hand, for many purposes gun metal of the 88-10-2 type is being wastefully employed, and service conditions can be equally well met by the use of lower tin content alloys, or even by cast brass.

GUN METALS

Mechanical Properties

Table 1 shows a comparison of mechanical properties at room temperature of the three gun metals under consideration against Admiralty gun metal.

Elevated Temperature Properties—Table 2 gives the mechanical properties principally based on short-time tensile tests, at elevated temperature. Considerable work has been done by Spring[3] on cast materials for high-temperature service, which shows that, while short-time tensile tests indicate that the higher tin content alloys of the 86-12-2 and 88-10-2 types are stronger than 86-7-5-2 gun metal at elevated temperature, the latter alloy is actually more creep resistant than the former at temperatures above 250° C. (482° F.). Spring gives the figures shown in Table 3 for creep resistance considered from the approximate limiting temperature standpoint.

[1] H. J. French, S. J. Rosenberg, W. Le C. Harbaugh and H. C. Cross. "Wear and Mechanical Properties of Railroad Bearing Bronzes at Different Temperatures," *Journal of Research*, Research Paper No. 13, U. S. Bureau of Standards, vol. 1, September, 1928.

[2] H. J. French and M. E. Staples. "Bearing Bronzes With and Without Zinc," vol. 2, (R.P. 68), June 1929.

[3] L. W. Spring. "Some Considerations and Tests for Cast Materials for High-Temperature, High-Pressure Service." Proc. Institute of British Foundrymen, vol. 24, 1930-31, p. 239.

Table I

Mechanical Properties of Low Tin Content Gun Metals and Cast Brasses in Comparison with 88-10-2 Gun Metal

	Gun Metal				Cast Brass	
	88-10-2	88-8-4	86-7-5-2	85-5-5-5	Type A	Type B
Properties, per cent	*Sn* 9.5—10.5 *Zn* 1.5—2.5 *Pb* 0.50 max. *Ni* 1.00 max. *Imp.* 0.15 max. *Cu* Balance	*Sn* 7.5—8.5 *Zn* 3.5—4.5 *Pb* 0.50 max. *Ni* 1.00 max. *Imp.* 0.15 max. *Cu* Balance	*Sn* 6.0—8.0 *Zn* 4.0—6.0 *Pb* 1.0—3.0 *Ni* 1.00 max. *Imp.* 0.50 max. *Cu* Balance	*Sn* 4.0—6.0 *Zn* 4.0—6.0 *Pb* 4.0—6.0 *Ni* 1.00 max. *Imp.* 0.50 max. *Cu* Balance	*Sn* 2.00 max. *Zn* Balance *Pb* 1.0—4.0 *Ni* 1.00 max. *Fe* 0.75 max. *Al* 0.01 max. *Imp.* 0.50 max. *Cu* 70.0—80.00	*Sn* 2.00 max. *Zn* Balance *Pb* 1.0—4.0 *Ni* 1.00 max. *Fe* 0.75 max. *Al* 0.25 max. *Imp.* 0.50 max. *Cu* 62.0—70.0
Y.P. (lbs. per sq. in.)	17,900—22,400	17,900—22,400	15,700—20,200	13,400—17,900	9,000—13,400	11,200—15,700
M.S. (lbs. per sq. in)	35,800—44,800	35,800—44,800	31,400—40,300	26,900—35,800	24,600—33,600	31,400—40,300
Elongation, % in 2 in.	10—30	10—30	12—30	15—35	20—40	15—35
Izod impact (ft.-lbs.)	7—17	7—17	7—17	6—12	10—20	—
Brinell hardness No.	65—80	65—80	60—70	55—65	40—60	45—65
Compressive strength (lbs. per sq. in., 0.001-in. defl.)	13,400—17,900	11,200—17,900	11,200—13,400	9,000—11,200	6,700—9,000	7,800—10,000
Modulus of elasticity (lbs. by 10^6)	12—14	12—14	12—14	11—13	11—14	12—14

Table 2

Mechanical Properties of Gun Metal at Elevated Temperatures

Temperature.		Per cent. Sn 12.25 Zn 1.46 Pb 0.01 Fe 0.01 Cu 86.21 †			Per cent. Sn 10.0 Zn 2.0 Cu 88.0 *			Per cent. Sn 10.11 Zn 1.63 Pb 0.36 Cu 87.84 ‖			Per cent. Sn 5.85 Zn 5.77 Pb 2.06 Cu 86.24 †			Per cent. Sn 5.99 Zn 5.10 Pb 2.33 Cu 86.28 †			Per cent. Sn 6.22 Zn 4.61 Pb 1.83 Cu 87.14 †					Per cent. Sn 5.24 Zn 5.48 Pb 5.33 Cu 83.37 *		
Deg. F.	Deg. C.	Y.P.	M.S.	Elong.	Elastic limit.	M.S.	Elong.	Y.P.	M.S.	Elong.	Y.P.	M.S.	Elong.	Y.P.	M.S.	Elong.	Y.P.	M.S.	Elong.	Charpy impact.	Creep strength.	Elastic limit.	M.S.	Elong.
70	20	8.9	18.0	15.0	11.4	15.2	8.0	8.3	15.2	14.0	7.4	17.0	36.5	7.1	15.2	20.5	7.3	17.5	31.2	20.0	6.25	7.5	14.2	21.0
200	93	—	—	—	—	—	—	—	—	—	6.7	16.6	37.5	—	—	—	6.7	16.7	27.2	—	—	—	—	—
300	150	—	—	—	9.8	16.1	8.6	—	—	—	6.4	15.8	31.0	—	—	—	6.6	16.8	28.7	—	—	5.7	11.8	18.8
400	205	—	—	—	—	—	—	7.5	15.0	18.0	6.7	15.2	28.5	—	—	—	6.3	15.9	25.5	19.5	—	—	—	—
500	260	3.2	14.4	5.5	—	—	—	5.9	11.8	11.5	5.8	13.0	24.5	—	—	—	5.8	14.6	20.5	15.2	4.0	—	—	—
555	288	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1.9	—	—	—
600	316	7.4	15.0	9.5	8.2	9.5	3.7	—	9.0	7.0	5.8	7.3	2.5	5.6	11.4	16.0	5.6	13.2	15.7	2.2	0.72	5.0	5.4	1.1
700	370	7.4	12.7	9.5	—	—	—	—	6.7	4.0	6.0	6.0	1.0	5.5	6.8	1.5	5.5	8.3	4.0	—	—	—	—	—
800	427	6.7	10.1	3.5	—	—	—	—	4.4	2.0	4.0	4.0	0	5.3	6.4	2.0	—	—	—	—	—	—	—	—
900	482	—	—	—	—	—	—	—	—	—	3.3	3.3	0	—	—	—	—	—	—	—	—	—	—	—

* Extracted from A.S.M.E.—A.S.T.M. Symposium on Effect of Temperature on the Properties of Metals, 1931.

† Extracted from Compilation of High-Temperature Creep Characteristics, A.S.M.E.—A.S.T.M., 1938.

‖ Courtesy of J. Arnott (G. & J. Weir, Ltd.).

Note: All figures for yield point, maximum strength, elastic limit and creep strength are in tons per sq. in. To convert to lbs. per sq. in. multiply by 2,240.

W. C. Stewart[4] publishes figures on creep properties given in Table 4.

It is interesting to note that the decreased tin and increased lead contents do not appear to affect creep properties appreciably. Further creep tests have been carried out on Admiralty gun metal and 86-7-5-2 gun metal by Bolton.[5] The alloys tested had the composition and room temperature properties in Table 5.

Creep tests were carried out on the alloys in Table 5 at temperatures of 260° C. (500° F.) 288° C. (550° F.) and 315° C. (599° F.) after being held in the creep test for periods ranging from 700 to 1,700 hrs. The specimens were also tested in tension at room temperature to determine whether long exposure at the temperature of creep testing had produced embrittlement.

Table 3

Creep Resistance of Two Bronzes

Material	Approx. temp. permitting creep of 1 per cent in 10,000 hrs. at 24,860 lbs. per sq. in. °F.	Approx. temp. permitting creep of 1 per cent in 10,000 hrs. at 1,000 lbs. per sq. in. °F.	Range, °F.
Cast red brass (5.63 Sn, 6.26 Zn, 2.71 Pb, balance Cu)	400	790	390
Cast bronze (11.98 Sn, 1.36 Zn, 0.16 Pb, balance Cu)	450	750	300

Table 4

Creep Properties of Two Bronzes

Material	Temperature °C.	Temperature °F.	Stress (lbs. per sq. in.) to produce a creep rate of 0.01 per cent per 1,000 hrs.	Stress (lbs. per sq. in.) to produce a creep rate of 0.01 per cent per 1,000 hrs.
88-10-2 gun metal	205	400	11,200	15,700
	260	500	6,050	8,960
	315	600	2,910	4,480
90-6-2-2 gun metal	205	400	8,960	13,450
	260	500	6,050	8,940
	315	600	3,140	4,030

It was found that the 86-7-5-2 gun metal was well suited for use up to 288° C. (550° F.), but not for higher temperatures. Its limiting creep strength, based on the stress to produce a rate of flow less than 0.1 per cent in 10,000 hrs. (0.24×10^{-5} in. per in. per day) after the first 500 hrs. of creep test and running up to 2,100 hrs. duration is about 8,000 lbs. per sq. in. at 260° C. (500° F.), and a design stress of 5,000 lbs. per sq. in. is recommended at this temperature. At 260° C. (500° F.), the load-carrying ability of Admiralty gun metal was lower than that of 86-7-5-2, and there was definite evidence of embrittlement. Bolton recommends that Admiralty gun metal should not be used above 232° C. (450° F.) and suggests a design stress of 5,000 lbs. per sq. in. at that temperature.

Quite recently, the American Society of Mechanical Engineers[6] have indicated maximum allowable working stresses for 86-7-5-2 and 85-5-5-5 gun metal in their Rules for Construction of Unfired Pressure Vessels, as shown in Table 6.

Table 5

Creep Properties of Two Bronzes

	Admiralty Gun Metal A.S.T.M. Spec. B.60	Bronze A.S.T.M. Spec. B.61
Copper	87.6 per cent	87.14 per cent
Tin	10.18 " "	6.22 " "
Zinc	2.2 " "	4.61 " "
Lead	Nil	1.83
Phosphorus	Trace	Trace
Max. strength, lbs. per sq. in.	49,050	37,860
Elong., per cent	35.4	34.3

[4] W. C. Stewart, Amer. Soc. Naval Engineers, 1938, vol. 50, p. 107.

[5] J. W. Bolton. Proc. Amer. Soc. Testing Materials, 1935, vol. 35, Part 2, pp. 204-217.

[6] "Rules for Construction of Unfired Pressure Vessels," Section 8, A.S.M.E. Boiler Construction Code, 1940 edition.

Table 6

Maximum Allowable Working Stresses in Pounds per Square Inch

Material.	For metal temperatures not exceeding deg. F.								
	Sub zero.	70 to 100.	150.	250.	350.	400.	450.	500.	550.
86/7/5/2 gunmetal	6,800	6,800	6,800	6,300	5,800	5,400	5,000	4,200	3,300
85/5/5/5 gunmetal	5,500	5,500	5,500	5,000	4,500	3,500	—	—	—

Bronze valves and fittings cast in 86-7-5-2 gun metal can be employed up to 500° F., while, if made in 85-5-5-5 material, the maximum temperature for use is limited to 400° F.

Sub-Zero Temperatures—Castings show a curious difference in behavior from wrought materials at low temperature, for while the strength is increased along similar lines to that which occurs in wrought materials, the ductility is always slightly less than that indicated at room temperature. Strauss[7] gives the data shown in Table 7 in connection with 88-8-4 gun metal.

Table 7

Properties of 88-8-4 Bronze at Subnormal Temperatures

Temperature	Lbs. per sq. in. Yield point	Lbs. per sq. in. Max. strength	Elong., % in 2 in.	R.A., per cent
20° C. (68° F.)......	18,600	40,100	31.3	36.7
—180° C. (—292° F.)	30,460	45,250	15.3	24.6

It can be assumed that changes of similar magnitude will occur in regard to the other gun metals under review. The alteration in properties with decreasing temperature may be generalized as follows: There is an *increase* in yield point, tensile strength, hardness, endurance limit, modulus of elasticity, and compressive strength, and a *decrease* in elongation, reduction of area, and impact resistance.

General Physical Properties

Typical values for such properties as specific gravity, coefficient of expansion, thermal conductiivity, etc., are given in Table 8. So far as the gun metals are concerned, there is little difference in general physical properties between 88-10-2 and the other types under review.

Corrosion Data

The increased lead and zinc contents within the range of compositions covered do not appear to have much effect on the corrosion resistance of gun metal by normal sea and fresh water. Table 9 outlines further comparative corrosion tests conducted on gun metal and bronze in fresh and sea water at 60 and 200° F.

It is interesting to observe that, while an increase of temperature accelerates the corrosion of gun metal and bronze in fresh water, the effect of hot sea water apparently reduces the rate of attack over that experienced in cold sea water, although the degree of attack is appreciably greater than that experienced in fresh water. Care should be taken when utilizing gun metals for handling softened boiler feed waters to keep the zinc content as low as possible.

Table 8

Physical Properties of Low Tin Content Gun Metals and Cast Brasses in Comparison with 88-10-2 Gun Metal

Properties.		Gunmetals.			Cast brass.	
		88/10/2 88/8/4	86/7/5/2	85/5/5/5	Type A.	Type B.
Specific gravity		8.6—8.8	8.6—8.8	8.6—8.8	8.45—8.55	8.4—8.5
Weight per cub. in. (lbs.)		0.314	0.314	0.314	0.30	0.30
Coefficient of expansion	20—100 deg. C.	17.5	17.7	17.8	17.9	19.4
	20—200 deg. C.	17.6	17.9	18.1	18.4	20.5
	20—300 deg. C.	17.9	18.2	18.4	19.0	21.8
	20—400 deg. C.	18.0	18.4	18.7	19.6	—
	20—500 deg. C.	18.1	18.6	19.0	20.2	—
Thermal conductivity .. .. / Electrical resistivity		Approx. 13—15 per cent. of that of copper at 20 deg. C.			Approx. 18—22 per cent. of that of Cu at 20 deg. C.	Approx. 16—20 per cent. of that of Cu at 20 deg. C.

Production Data

Foundry Characteristics—Gun metals of the 88-8-4, 86-7-5-2 and 85-5-5-5 types are no more difficult to handle in the foundry than standard Admiralty gun metal. As a matter of fact, both 86-7-5-2 and 85-5-5-5 possess superior castability and are particularly adaptable to the production of pressure castings in large numbers. Similar pouring temperatures to those employed for 88-10-2 (1,160 to 1,180° C. or 2,120 to 2,156° F. for test bars) give perfectly satisfactory results with the other alloys under review.

Patternmakers shrinkage for all the alloys is around 3/16 in. per ft. It should be noted that there is little danger of lead segregation occurring in gun metal containing up to 6 per cent lead, so far as castings of average section (up to 1¼ in.) are concerned, but this point will have to be watched in heavier sections, particularly when using 85-5-5-5.

Machinability—The machinability of 88-8-4 gun metal will be similar to Admiralty gun metal, while 86-7-5-2 and 85-5-5-5 will tend to be slightly better.

Table 9

Corrosion of Cast Bronze, Gun Metal and Brass in Fresh and Sea Water at 60 and 200 degrees Fahrenheit

Alloy.	Loss in grammes per sq. m. per 24 hrs.			
	Tap water.		Sea water.	
	60 deg. F.	200 deg. F.	60 deg. F.	200 deg. F.
Admiralty manganese brass	0.27	0.43	1.19	2.00
Gunmetal (85/9/2½/3½)	0.14	0.28	1.23	0.75
Cast phosphor bronze	0.09	0.11	1.20	0.64
Cast 90/10 bronze ..	0.14	0.19	0.87	0.71

[7] J. Strauss. "Metals and Alloys for Industrial Applications Requiring Extreme Stability." *Trans. Amer. Soc. Steel Treating*, 1929, vol. 16, p. 191.

Soldering and White Metaling—All the alloys under review are readily soldered and white metaled.

Brazing and Welding—Brazing by the usual methods should be quite successful with all the gun metals mentioned.

Welding operations on gun metal are difficult to conduct due to the extreme heat fragility of the alloy and the production of zinc fume. Satisfactory results are most likely to be obtained by the use of the metallic arc process, using phosphor-bronze type electrodes in conjunction with pre-heating. With these electrodes 88-10-2 and 88-8-4 should give good results in "building up" or repairs.

In the case of gun metals of the 86-7-5-2 and 85-5-5-5 types, welding operations become increasingly difficult and it may be more practical to adopt oxy-acetylene brazing methods. The carbon arc process could also be employed in many cases, using phosphor-bronze filler rods, containing 3 to 10 per cent tin and about 0.3 per cent phosphorus.

Again, alloys 88-10-2 and 88-8-4 should give fairly good results, but 86-7-5-2 and 85-5-5-5 types will be more difficult. In general, the success of the process depends to a large extent on the soundness of the castings, gassy castings being almost impossible to weld without the production of gassy welds. The high thermal conductivity of gun metals frequently renders the oxyacetylene welding process difficult.

Table 10

Pouring Temperatures for Types A and B Cast Brasses

Section of Casting		*Pouring Temperature* — *Type A*	*Pouring Temperature* — *Type B*
Light	°C.	1,200—1,100	1,150—1,050
	°F.	2,192—2,012	2,192—1,922
Medium	°C.	1,100—1,050	1,050—1,000
	°F.	2,012—1,922	1,922—1,832
Heavy*	°C.	1,050—1,000	1,000— 970
	°F.	1,922—1,832	1,832—1,778

*Range for test bars.

Applications—Examples of suggested applications for the modified gun metals are outlined in Table 11.

CAST BRASSES

Mechanical—The mechanical properties at room temperature are included in Table 1.

Elevated Temperature Properties—Cast brasses types A and B are not recommended for use at elevated temperatures and there is no published data available of their mechanical properties.

Subnormal Temperature Properties—The general remarks on mechanical properties at subzero temperatures given for gun metals can be applied to the cast brasses. The effect of low temperatures is not likely to cause any serious change in mechanical properties, apart from some reduction in ductility. For their general physical properties see Table 8.

Corrosion Data

In general, the corrosion resistance of these alloys in sea water is not quite so good as the gun metals, but in contact with petrol or fuel oils containing sulphur their resistance is much greater. Care must be taken when applying the cast brasses to industrial applications to prevent the possibility of "dezincification" arising. This is best avoided by the use of alloys containing not more than 20 per cent zinc and in addition the presence of at least 0.03 per cent of an inhibitor, either arsenic, antimony or phosphorus.

Lines[8] recently established corrosive conditions that resulted in complete "dezincification" of 0.35-in. diam. plain 70-30 and Naval brass rod in a period of 10 weeks. Under similar conditions the same alloys, modified by about 0.03 per cent arsenic, antimony or phosphorus, did not dezincify nor did corrosion progress along grain boundaries.

The test results on the uninhibited Naval brass are of interest. It is fairly well established that the 1 per cent tin associated with this alloy is a retardant of "dezincification." The results of Lines' work are in agreement with this statement when temperatures of around 70° F. are involved. At 150° F., however, it was found that tin was without

[8] W. Lines. "Prevention of Dezincification," *Metal Industry*, October 31, 1941.

Table 11

Suggested Applications of Gun Metals and Cast Brasses

Type Composition	*Suggested Application*
Gun Metals	
88-10-2	To be used only for special applications, *i.e.*, high-pressure hydraulic and air valves working between 1,000—4,000 lbs. per sq. in, control and stop valves, steering gear telemotor cylinders. Special unlubricated bearings subjected to pounding, vibration and corrosion, *e.g.*, rudder post liners and bushes, steering gear bearings, etc.
88-8-4	Suitable for conditions of service intermediate between those specified for alloys of 88-10-2 and 86-7-5-2 type, *e.g.*, hydraulic valves working between 500—1,000 lbs. per sq. in. (Does not possess much advantage over alloy of 86-7-5-2 type so far as steam service is concerned.) Sea cocks and other valves connected direct to hull below water line.* Pump impellers. Stern tubes.
86-7-5-2	Suitable for all general -purpose castings subject to medium steam pressures (above 100 lbs. per sq. in. working pressure) and at temperatures not exceeding 500° F. (260° C.), *e.g.*, small engine control and boiler stop valves, cylinder cover bushes, neck rings, centrifugal pump casings, tail shaft liners and stern tube bushes. Hydraulic valves operating between 200—500 lbs. per sq. in. pressure. Suitable for high-grade backings of lined bearings. Slip rings for electrical equipment (under 2 per cent lead if possible).
85-5-5-5	Suitable for general-purpose castings subject to steam up to 100 lbs. per sq. in. working pressure and temperatures not exceeding 400° F. (205° C.) and water pressures up to 200 lbs. per sq. in. working pressure, *e.g.*, screw down valves, bulkhead and deck fittings, tee-pieces, etc., handling auxiliary steam heating services to galleys, pantries and thermo-tanks. Cocks, taps and sanitary fittings handling sea water, *e.g.*, pump type lavatory valves. Pumping, flooding and draining valves not directly connected to hull below water-line. Sluice valves to sea cocks. Fire hose connections. Centrifugal pump casings. Suitable for well-supported backings of certain lined bearings, *e.g.*, small stern tube bushes, etc.
Cast Brasses	
Type A (70—80 per cent Cu)	Suitable for low-pressure fittings working under mildly corrosive conditions (not recommended for use at elevated temperatures or for conditions requiring exceptional wear and tear), *e.g.*, cocks, taps, pipe connections and sanitary fittings for use in fresh water at pressures up to 100 lbs. per sq. in. Ventilating valves. Name plates. Lubricators. Better resistance to oils containing sulphur than gun metal, therefore can be used with advantage for valves and fittings handling fuel oil and petrol.
Type B (62—70 per cent Cu)	Non-pressure structural and ornamental castings. Pressure gauge and telegraph cases. Voice pipe fittings and connections. Funnel fittings. Hand wheels. Gear case covers. Steering wheel brackets. Porthole and skylight casings. Motor-boat deck fittings. Bearing backings where a copper alloy is required and the backing need not in itself possess bearing properties.

*The use of cast aluminum bronze is more suitable, as there is no galvanic action between this alloy and steel in the presence of sea water.

influence on the rate of the dezincification reaction.

Dezincification is encountered with corrosive water supplies in plumbing work with alloys such as Muntz metal, containing 60 per cent copper, 40 per cent zinc and with brasses containing 67 per cent copper, 32.5 per cent zinc, 0.5 per cent lead. It is particularly serious at hot water temperatures, resulting in some cases in very short life of the installation. In condenser tube applications for marine power plants and the oil industries, dezincification occurs with Naval brass containing 70 per cent copper, 1 per cent tin and 29 per cent zinc.

In view of the foregoing remarks, it will be advisable to utilize cast brass, Type A, for those castings required to resist corrosion, keeping composition as far as possible to the 80 per cent copper end of the specification, and to include preferably 0.03 per cent phosphorus, as an inhibitor. The presence of around 1.0 per cent tin will also be of benefit in minimizing corrosion. Cast brass, Type B, should be reserved for applications not subject to corrosion or where a protective coat of paint can be readily applied.

Production Data

Founding Characteristics—Cast brass, Type A, has good castability, and is not difficult to handle in the foundry. It is suitable for small pressure work and the best results are obtained in this direction at the 80 per cent copper end of the compositional range. The presence of tin and lead assists the production of sound castings, but care must be taken to exclude aluminum as far as possible. Over 0.01 per cent of this element will produce excessive porosity. The production of brass castings also entails the use of more permeable molds than used for gun metal, particularly as regards green sand work. Gating and feeding methods are similar to gun metal.

Cast brass, Type B, is more difficult to handle, particularly as the 62 per cent copper end of the compositional range is approached. As most of the supplies of this material will be obtained from scrap, it is possible that manganese will also be present from time to time, and it will, therefore, be advisable to handle this alloy in the foundry along similar lines to manganese bronze, taking the precaution of providing heavier gates and risers than one would normally allow for gun metal. The presence of maximum tin and aluminum contents allowed will tend to aggravate troubles due to the above, and promote brittleness.

A guide to suitable pouring temperatures is shown in Table 10. Patternmakers' shrinkage will vary from 3/16 in. per ft. for cast brass, Type A, up to ¼ in. per ft. for Type B.

Machinability—The machinability of both Types A and B cast brass is excellent.

Soldering and White Metaling—Both the cast brasses under review are readily soldered and white metaled, even with the maximum allowed aluminum content of 0.25 per cent.

Brazing and Welding—Brazing by the usual methods should be quite successful, except in the case of Type B brass when considerable care will be necessary when the copper content is at the low end of the range and a high melting point brazing spelter is used. Welding operations conducted on the cast brasses should give little trouble with the oxyacetylene process, using an oxidizing flame and brass filler rods of the proper type. Electric welding is not recommended with Types A and B.

Applications—Examples of suggested applications for cast brass, Types A and B, are given in Table 11.

Jim Allan Speaks at Chicago Area Meeting

SPEAKING before a plant protection conference of the Chicago Metropolitan area in Chicago April 2, Jas. R. Allan, International Harvester Co., Chicago, and Chairman of the A.F.A. Industrial Hygiene Codes Committee, described the area's accomplishments in providing wartime plant protection measures. He told how the protection code adopted for the area last year has been accepted by industry through cooperation of the local fire departments of Chicago.

Mr. Allan particularly stressed the importance of protective measures being taken by small plants as well as large ones, and pointed out that it is management's duty to prevent relaxation on the part of a plant's protective organization.

The Chicago area code, like a number of other area codes in use throughout the country, was patterned closely after the A.F.A. Code for Protection of Foundry Plants and Personnel in Wartime, prepared under the leadership of Mr. Allan early in 1942, and widely accepted by the foundry industry for its thoroughness and economical installation.

When Whiting Corp., Harvey, Ill., paid tribute to 422 employees who have been with the company 5, 10, or over 25 years, the meeting was addressed by President Howard D. Grant and service pins presented the "old timers." They also received a portrait of John Hill Whiting, founder of Whiting, as a symbol of friendship. Seventy employees have service records of 25 years or more with the 59-year-old organization.

New Members

Hats off to ALL the A.F.A. Chapters! This past month all 24 Chapters came through by enrolling a total of over 150 new members . . . a splendid showing. Chicago Chapter led the field with 21 new members, while out on the Pacific Coast the Northern California Chapter ran second with 13.

(March 14 to April 15, 1943)

Conversions
Company from Personal—

***Fulton Iron Works Co., St. Louis, Mo. (Herman Harte, Foundry Supt.)**
***National Foundry & Machine Co., St. Louis, Mo. (Wm. L. Heckmann, Pres.)**
***Reliable Iron Foundry, Los Angeles, Calif. (A. H. Popperwell, Vice-Pres.)**
***Standard Foundry Co., Worcester, Mass. (Warren Van N. Baker, Metallurgist)**

Birmingham District Chapter

***Berman Bros. Iron & Metal Co., Birmingham, Ala. (Robert Berman, Pres.)**
***Knight Iron & Metal Co. (J. T. Knight, Pres.)**
B. A. Louden, Sales Engineer, American Castings Co.
***McConnell Sales & Engineering Co., Birmingham (Douglas McConnell, Partner)**
Jas. R. Reynolds, Fdy. Fmn., American Castings Co.
Buell B. Warren, Y.M.C.A. Secretary, American Cast Iron Pipe Co., Birmingham.

Central Indiana Chapter

Fred Carl, Metallurgist, Delco-Remy Div., General Motors Corp., Anderson, Ind.
***Delco-Remy Div., General Motors Corp., Anderson (B. A. Dollens, General Supt.)**
G. R. Dellinger, Heat Treat Foreman, Cummins Engine Co., Columbus, Ind.
Benjamin J. Hart, Foundry Engineer, Delco-Remy Div., General Motors Corp., Anderson.
Louis M. Hirsch, Metallurgist, Delco-Remy Div., General Motors Corp., Anderson.
***Light Metals, Inc., Indianapolis, Ind. (Harry R. Howell, Plant Supt.)**
Paul T. Maul, Sand Technician, Delco-Remy Div., General Motors Corp., Anderson.
John L. Petresky, Foreman, Delco-Remy Div., General Motors Corp., Anderson.

Central New York Chapter

H. R. Brakeman, Owner, City Pattern Shop, Syracuse.
Douglas C. Williams, Sand Research Fellow, College of Engineering, Cornell University, Ithaca, N. Y.

Chesapeake Chapter

Kenneth L. Clark, Contract Metallurgist, Naval Research Laboratory, Washington, D. C.
W. Wallace McKaig, Owner, McKaig's, Cumberland, Maryland.
Ralph R. Rock, Landis Tool Co., Waynesboro, Pa.
Edward A. Rominski, Metallurgist, Naval Research Laboratory, Washington.
***Standard Gas Equipment Corp., Baltimore, Md. (Earl McGee, Chief Engineer)**

Chicago Chapter

Henry W. Bowers, Management Development, Foundry Equipment Division, Whiting Corp., Harvey, Ill.
J. Ross Drever, Operating Engineer, American Steel Foundries, Chicago.
Gordon S. Foster, Works Engineer, American Steel Foundries, East Chicago, Ind.
W. B. Goitra, Sales Engineer, American Steel Foundries, East Chicago, Ind.
L. G. Jessup, Technician, Federated Metals Division, Whiting, Ind.
J. Robert Johnston, Pat. Atty., Castings Patent Corp.
Herbert H. Klein, Sales Mgr., L. A. Cohn & Bro., Inc.
***Monarch Foundry Co., Plano, Ill. (Ellis M. Johns, Co-Owner)**
W. H. Murphy, Vice-Pres., Castings Patent Corp.
George L. Pollock, Secy., Sivyer Steel Castings Co.
Harold I. Pratt, Heat Treat Foreman, American Steel Foundries, East Chicago.
R. F. Ringham, Metallurgist, Continental Roll & Steel Foundry, East Chicago.
Frank J. Satek, Jr., Metallurgist, Continental Roll & Steel Foundry, East Chicago.
Harry A. Schuler, Sales Engineer, Robins Conveyors, Inc., Chicago.
Joseph P. Schneider, Fdy. Engr., Hydro-Blast Corp.
***Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., Chicago (Jack L. Stroman)**
Dr. Robert F. Thomson, Metallurgist, Chrysler Corp., Dodge-Chicago Plant, Chicago.
Michael E. Toman, Vice-President, Castings Patent Corp., Chicago.
William F. Whittingham, Jr., Foundry Foreman, American Steel Foundries, East Chicago.
Robert Wisely, Sales Engineer, Chicago, Ill., Modern Equipment Co., Port Washington, Wis.

Cincinnati District Chapter

Wm. H. Braun, General Foreman, Wright Aeronautical Corp., Lockland, Ohio.
H. J. Felix, Sales & Service, Masters Engineering Co., Cincinnati.

Detroit Chapter

Earle A. Beeman, Beeman Sales & Engineering Co.
Frank R. Burczyk, Owner, Frank R. Burczyk Co.
Russell C. Gault, Resident Metallurgist, Chrysler Corp., Plymouth Div., Detroit.
Alfred Bracey Gold, Industrial Engineer, Aluminum Co. of America, Detroit.
Charles A. Hartner, Treasurer, National Alloys Co.
Z. Lucas, General Manager, Hackett Brass Foundry.
Wayne M. Robbins, Metallurgist, Aluminum Co. of America, Detroit.
Raymond Sassen, Foundry Foreman, Detroit Hardware Manufacturing Co., Detroit.
R. C. Schmeling, Casting Buyer, Vinco Corporation.
R. A. Terrace, Fdy. Chem., Packard Motor Car Co.

Eastern Canada and Newfoundland Chapter

Wilfred Legare, Proprietor, La Fonderie Legare, Sherbrooke, Que.
Leonard Nole, Coremaker, Robert Mitchell Co. Ltd., St. Laurent, Que.
Andrew Reyburn, Foundry Engineer, Wartime Merchant Shipping Ltd., Montreal, Que.

Metropolitan Chapter

William F. Bischoff, Vice-President, Riker-Bischoff Corp., New York.
John A. Bukowski, Plant Metallurgist, Worthington Pump & Machinery Corp., Harrison, N. J.
Michael Byra, Leadman-Coreshop, Wright Aeronautical Corp., Paterson, N. J.
A. Edward Conover, Jr., Sales, Robins Conveyors, Inc., Passaic, N. J.
John P. Nielsen, Research Metallurgist, International Nickel Co., Bayonne, N. J.
Bernard Wepf, Wedemann & Godknecht, Inc., New York.

Michiana Chapter

L. E. Cramer, Foundry Foreman, American Foundry Equipment Co., Mishawaka, Ind.
J. M. Evans, Engineer, American Foundry Equipment Co., Mishawaka.
John H. Hock, Refractories Engineer, Chicago Retort & Fire Brick Co., Chicago.
Thomas J. Hutchison, Jr., Metallurgist, American Foundry Equipment Co., Mishawaka.
C. A. Snyder, Engineer, American Foundry Equipment Co., Mishawaka.

Northeastern Ohio Chapter

***Castings Patent Corp., Cleveland (Henry F. Hagemeyer, Pres.)**
Joseph J. Cooper, Assistant Metallurgist, Aluminum Co. of America, Cleveland.
Robert S. Cunnington, Brocksville, Ohio, Electro Refractories Co., Buffalo, N. Y.

*Company Members.

William G. Gude, Associate Editor, The Foundry, Cleveland.
A. J. Harlan, Hickman-Williams & Co., Cleveland.
Ralph W. Hisey, Vice-President, Osborn Manufacturing Co., Cleveland.
Chester Lewis, National Malleable & Steel Castings Co., Cleveland.
***National Aluminum Cylinder Head Co., Cleveland (Frank M. Rule, Plant Supt.)**
George William Schmitt, Columbus, Ohio, Foundry Technician, L. A. Cohn & Bro., Inc., Chicago.
***Wellman Products Co., Cleveland (W. B. Burt, Sales Mgr.)**

Northern California Chapter

Arnold Boscacci, Owner, American Brass & Iron Foundry, Oakland.
Felix Castro, Molder, Enterprise Engine & Foundry Co., So. San Francisco.
Russell G. Dehony, Coremaker, Enterprise Engine & Foundry Co., So. San Francisco.
Julio Fambrini, Enterprise Engine & Foundry Co., So. San Francisco.
James L. Heaney, Coremaker, Enterprise Engine & Foundry Co., So. San Francisco.
A. F. Lewis, Apprentice Molder, Enterprise Engine & Foundry Co., So. San Francisco.
Walter Mackey, Core Room Foreman, Enterprise Engine & Foundry Co., So. San Francisco.
John Mangini, Molder, Enterprise Engine & Foundry Co., So. San Francisco.
Anthony J. Russo, Apprentice Coremaker, Enterprise Engine & Foundry Co., So. San Francisco.
John Russo, Coremaker, Enterprise Engine & Foundry Co., So. San Francisco.
D. A. Spencer, Grove Regulator Co., Emeryville.
Joseph M. Toolon, Coremaker, Enterprise Engine & Foundry Co., So. San Francisco.
***Valley Foundry & Machine Works, Inc., Fresno (Leon S. Peters, Pres.)**

Northern Illinois-Southern Wisconsin Chapter

***Liberty Foundries Co., Rockford, Ill. (C. M. Dale, Mgr.)**

Ontario Chapter

***Acme Foundry Co., Saskatoon, Sask. (Alex McLeay, Partner)**
Chas. A. Burrows, Moulder, Vivian Engine Works, New Westminster, B. C.
***Empire Brass Mfg. Co., Ltd., London, Ont. (H. Smith, Supt.)**
***Manitoba Bridge & Ironworks, Ltd., Winnipeg, Man. (J. A. Ogden, Chief Engineer)**
James McGill, Foundry General Foreman, Riverside Iron Works Ltd., Calgary, Alta.
P. G. Meurer, Superintendent, Manitoba Bridge & Ironworks, Ltd., Winnipeg, Man.
***Riverside Iron Works Ltd., Calgary, Alta. (J. P. Carroll, Gen. Mgr.)**
***Whiting Corporation (Canada) Ltd., Toronto, Ont. (Alex Ritchie, Asst. Gen. Mgr.)**
Reg. Williams, Chief Chemist, McKinnon Industries, Ltd., St. Catharines, Ont.

Philadelphia Chapter

J. H. Cole, Sales, Chicago Pneumatic Tool Co., Philadelphia.
Roy W. Daub, Assistant Planning Engineer, Lebanon Steel Foundry, Lebanon, Pa.
Loris M. Diran, Metallurgist, Lebanon Steel Foundry, Lebanon.
Harvey I. Mason, Coremaker, Penn Steel Casting Co., Chester, Pa.

Quad-City Chapter

Frank A. Komatar, Heat Treat Foreman, Union Malleable Iron Co., East Moline, Ill.

St. Louis District Chapter

***Acme Brass Foundry, St. Louis (Theodore Meeker, Partner)**
Charles Broz, Plant Superintendent, National Foundry & Machine Co., St. Louis.
Alfred Clements, Core Room Foreman, National Foundry & Machine Co., St. Louis.
Edward Holzer, Foundry Superintendent, National Foundry & Machine Co., St. Louis.
James H. Maddern, Plant Manager, National Foundry & Machine Co., St. Louis.
***Mt. Vernon Car Manufacturing Co., Mt. Vernon, Ill. (L. A. Bedard, Mgr. of Sales)**
M. E. Nordman, St. Louis, Representative, Federal Foundry Supply Co., Cleveland.
Joseph M. Quinn, Personnel Director, National Foundry & Machine Co., St. Louis.
Paul C. Schwarz, Foreman, National Bearing Metals Corp., St. Louis.
Raymond S. Taylor, Foundry Manager, National Youth Administration, Louisiana, Mo.

Southern California Chapter

***Aircraft Alloys Inc., Los Angeles (John Hall, Gen. Mgr.)**
Eugene Louis Fisher, Chemist & Metallurgist, Washington-Eljer Co., Los Angeles.
Fred P. Jones, Foundry Foreman, James Jones Co., Los Angeles.
Henry Mann, Purchasing Agent, Aircraft Alloys Inc., Los Angeles.
Lee Nelson, Owner, Compton Pattern Shop, Compton.

Toledo Chapter

W. P. Mack, Bruce Foundry Co., Tecumseh, Mich.
Louis Mussman, Ohio Steel Foundry Co., Lima, Ohio.

Twin-City Chapter

Bert Benson, Coremaker, Scott Atwater Foundry, Minneapolis.
G. A. Dotson, General Manager, Dotson Co., Mankato, Minn.
***Midway Iron Works, St. Paul (F. X. Wukawitz, Owner)**

University of Minnesota Student Chapter

J. Lawrence Carlson, Student, Univ. of Minnesota.
Stuart McCullough, Student, University of Minnesota.
Arnold Satz, Student, University of Minnesota.
Phillip J. Watterberg, Student, Univ. of Minnesota.

Western Michigan Chapter

Hale Burnham, Manager-Steel Div., Lakey Foundry & Machine Co., Muskegon, Mich.
Don V. Bushong, Superintendent-Core Room, Lakey Foundry & Machine Co., Muskegon.
Earl H. Evans, Manager-Foundry & Core Room, Lakey Foundry & Machine Co., Muskegon.
Kenneth Evans, General Foreman-Foundry, Lakey Foundry & Machine Co., Muskegon.
Paul Manak, Foreman-Squeezer & Job Molding, Lakey Foundry & Machine Co., Muskegon.
Leo Mudge, Supervisor-Production in Core Room, Lakey Foundry & Machine Co., Muskegon.
Gordon Robidoux, General Superintendent-Foundry, Lakey Foundry & Machine Co., Muskegon.

Western New York Chapter

***American Magnesium Corp., Buffalo, N. Y. (C. H. Delamater, Plant Mgr.)**
***Dunkirk Foundries, Inc., Dunkirk, N. Y. (E. L. Fisher, Secretary and General Mgr.)**

Wisconsin Chapter

Adrian Archambault, Foundry Instructor, Wisconsin Vocational School, Madison, Wis.
***Delta Mfg. Co., Milwaukee (Michael C. Frankard, Purchaser of Patterns and Castings)**
A. P. Knauber, Proprietor, North Side Pattern Works, Milwaukee.
David Watson, Patternmaking Instructor, Board of Vocational and Adult Education, Manitowoc, Wis.

Outside of Chapter

***Cunningham Steel Foundry, Seattle, Wash. (Eugene Cunningham, Gen. Mgr.)**
Alexander Haigh, Boston, Mass.
Ernest G. Jones, Superintendent-Steel Plant, Isaacson Iron Works, Seattle, Wash.
Harold W. Lownie, Jr., Metallurgical Engineer, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
L. R. McCullough, Works Manager, Cunningham Steel Foundry, Seattle, Wash.
Faelton C. Perkins, Jr., Assistant Metallurgist, American Locomotive Co., Schenectady, N. Y.
Jennings Raeder, Melter, Shenango Penn Mold Co., Dover, Ohio.
Robert W. Trimble, Foundry Superintendent, Bethlehem Supply Co., Tulsa, Okla.

Government Orders of the Day for Industry

More detailed information on any of the following news briefs may be obtained by writing direct to the U. S. Information Center, 1400 Pennsylvania Ave., N.W., Washington, D. C. For prompt reply, it is suggested that requests be made by Release numbers shown.

Materials

Discuss Alloy Reduction. (WPB)—The need to reduce the use of critical alloy metals in production of cast steel, cast iron, malleable iron and highly alloyed castings was discussed recently at meeting of Ferrous Foundry Industry Advisory Committee with officials of Steel Division of W.P.B. *(Release No. WPB-2974)*

Change Smelter's Procedure. (WPB)—Simplified procedure prescribed March 24 to be used henceforth by smelters and refiners of 13 non-ferrous metals, now obtaining maintenance, repair and operation supplies under Pref. Rating Order P-73. *(Release No. WPB-2940)*

Aluminum Use Under CMP (WPB)—Firms receiving CMP allotments of aluminum are authorized to use metal for specified group of end-products, by Order M-1-i, amended March 10. *(Release No. WPB-2804)*

Revised Aluminum Form. (WPB)—Revised aluminum inventory and consumption reporting form for use by aircraft consumers of metal announced Feb. 16 by Aluminum and Magnesium Division. *(Release No. WPB-2559)*

Pig Aluminum Maximums. (OPA)—Maximum prices for aluminum sold in pig form set at levels 1c per lb. below prices of corresponding ingots, under Order 353 of Sec. 1499.3(b) of Gen. Max. Price Reg., eff. March 30. *(Release No. OPA-2101)*

More Copper Limitations. (WPB)—Restrictions on use of copper and copper base alloy products in manufacture of automotive parts extended by Limitation Order L-166, amended by Dir. Gen. for Operations. *(Release No. WPB-2751)*

Restore Lead Ingot Maximums. (OPA)—Maximum prices for primary lead ingots and linked ingots, reduced $5 per ton eff. Jan. 20, restored to former level of $10 per ton over max. price for pig lead, by Amend. 4 to Rev. Price Sched. 69 (Primary Lead), eff. April 3. *(Release No. OPA-T-709)*

Set Ferrochrome Formula. (WPB)—Formula governing computation of ferrochrome requirements for stainless steel outlined by Steel Division Director in recent letter to producer. *(Release No. WPB-2935)*

Ferrocolumbium Allocated. (WPB)—Ferrocolumbium added to list of critical metals now completely allocated, under Pref. Order M-296, eff. March 25. *(Release No. WPB-2928)*

Manganese Exemptions. (OPA)—Sales of domestic metallurgical manganese ore to dealers for resale, and to users or processors for use in steel or foundry production, or in spiegeleisen and other sub-standard ferromanganese, exempted from price control by Amend. 2 to MPR-248, eff. Feb. 20. *(Release No. OPA-T-590)*

Prices for Nickel in Pig Iron. (OPA)—Amend. 5 to RPS-10, eff. March 10, allows addition of $2 per ton to base price for nickel in pig iron between 0.5 and 0.75 per cent, and $1 per ton for each additional 0.25 per cent. *(Release No. OPA-T-610)*

Plan Pig Iron Increase. (Solid Fuels Coordinator for War)—Program to increase pig iron production by 50 tons per blast furnace daily offered Feb. 17 by Coordinator Ickes. *(Release No. OWI-1289)*

Zinc Slab Control. (OPA)—Secondary slab zinc that fails to meet specifications for prime Western grade must be sold below maximum price, ruled March 13 in MPR-3, eff. March 18. *(Release No. OPA-T-646)*

Set Coke Allocation Basis. (WPB)—Order issued March 12 in M-292 under which coke made from bituminous coal can be allocated, if action becomes necessary. *(Release No. WPB-2824)*

Coke Prices Adjusted. (OPA)—Beehive coke produced in 3 counties of W. Va. adjacent to and usually considered in Connellsville district, to be priced under same reguation as for Pennsylvania beehive coke, under Amend. 6 to RPS-77, eff. April 6. *(Release No. OPA-2083)*

Charcoal Curtailed. (WPB)—Use of charcoal for restaurant, cooking, picnics and civilian heating will be curtailed sharply by GPA-289, issued Feb. 27. *(Release No. WPB-2686)*

Urge Tung Oil Substitute. (Dept. Agr.)—Tung oil users urged to substitute oiticica oil for tung oil whenever possible, to conserve existing supplies of tung and prevent deterioration of oiticica stocks. *(Release No. AG-136)*

Conserving Oils Stressed. (WPB)—Because of critical supply of castor, tung and oiticica oils, necessity for curtailment stressed at meeting of Oleo Resinous and Tower Oil Coating Industry Advisory Comm. in Washington, March 4. *(Release No. WPB-2766)*

Tung Oil Control. (Dept. Agr.)—Food Distribn. Order 39, eff. March 24, establishes closer control over tung oil supplies, making necessary specific authorization to deliver or accept delivery. *(Release No. AG-191)*

Restrict Drying Oils. (WPB)—Decreases in drying oils, plus increasing needs of armed forces, necessitate cut in amount for civilian use, Paint Varnish and Lacquer Industry Advisory Comm. informed recently. *(Release No. WPB-2688)*

Linseed Ceilings. (Dept. Agr.)—Proposed price ceilings for linseed oil and meal discussed by industry representatives and Govt. officials, Dept. Agriculture announces. *(Release No. AG-84)*

Shot Pricing Changed. (OPA)—Brass and bronze alloy shot added to maximum price regulation for brass and bronze alloy ingot, by Amend. 3 to MPR-202, eff. April 12. *(Release No. OPA-2169.)*

Clarify Mahogany Order. (WPB)—Restrictions in use of mahogany, Philippine mahogany and Albarco lumber clarified by Conservation Order M-122 as amended March 13. *(Release No. WPB-2818)*

Plywood Supply Critical. (WPB)—Softwood Plywood Industry Advisory Comm. recommends WPB study possibilities of total allocation of softwood plywood, now critically limited. *(Release No. WPB-2620)*

Scrap

Scrap Conservation Ordered. (WPB)—To conserve critical alloys, steel mills ordered March 24, Order M-21-a as amended, to make more extensive use of scrap turnings. *(Release No. WPB-2913)*

Modify Aluminum Scrap Pricing. (OPA)—Price regulation for aluminum scrap and secondary aluminum ingot changed March 25 to permit secondary smelters in strictly defined cases to pay baling and briquetting premiums for three grades of plant scrap and to add ½c lb. to max. prices for ingot made from same scrap, under Amend. 6 to RPS-2 as amended, eff. March 31. *(Release No. OPA-T-698)*

Copper Scrap Salvage. (WPB)—No. 1 industrial salvage problem in 1943 is copper scrap, stated by WPB Industrial Salvage Chief, although iron and steel scrap collection must be maintained at high level. *(Release No. WPB-2622)*

Copper Scrap Restriction. (WPB)—Dealers who accept copper materials as scrap may not dispose of it in any other form, except with specific WPB permission, under revision of S.O. M-9-b, issued March 11. *(Release No. WPB-2798)*

Set Copper Scrap Prices. (OPA)—By establishing specifications and cents per lb. prices for 16 new grades of copper scrap and copper alloy scrap, entire field of such material brought under specific prices in MPR-20, eff. March 22. *(Release No. OPA-T-648)*

Copper-Beryllium Scrap Control. (WPB)—Copper scrap and copper base alloy scrap containing 0.0% or more beryllium to be delivered only to those specifically authorized by WPB, under Supp. Order M-9-b, as amended March 1. *(Release No.* WPB-2664)

Iron-Steel Scrap Report. (WPB)—Scrap collections of iron and steel

in last half 1942 were 95.7% of national quota of 17,000,000 tons, announced by Dir. of Salvage. *(Release No. WPB-2704)*

Modify Cast Iron Pricing (OPA)—Conditions under which gray iron castings sellers may apply for adjustment of maximum prices, specified in Amend. 3 to MPR-244, eff. March 15. *(Release No. OPA-1868)*

Gray Iron Castings Defined. (OPA)—Definition in Amend. 4 to MPR-244, eff. March 27, will enable sellers of gray iron castings, or products containing same, to determine whether max. price regulation for gray iron castings or some other price regulation governs pricing. *(Release No. OPA-T-673)*

Iron and Steel Deliveries. (WPB)—To eliminate possible confusion from operation of CMP, certain changes made in Order M-21 governing deliveries of iron and steel products, under amendment issued April 1. *(Release No. WPB-3013)*

Non-Ferrous Castings Prices. (OPA)—Date on which sellers of non-ferrous castings must stop billing purchasers at higher prices specified in earlier contracts postponed to April 1st, under Amend. 2 to RMPR-125, eff. March 1. *(Release No. OPA-T-636)*

Ease Steel Castings Price Rules. (OPA)—Steel foundries authorized to add all transportation costs above 50c per 100 lbs. to maximum prices for castings for deliveries far beyond normal market areas, under Amend. 5 to Rev. Price Sched. 41 (Steel Castings), eff. March 28. *(Release No. OPA-T-710)*

Auto Parts Control. (WPB)—New methods to control production of automotive replacement parts, to fit in with CMP, established March 11 in Limitation Order L-158 as amended. *(Release No. WPB-2816)*

Amend Pipe Flange Rule. (WPB)—Greater use of gray cast iron and malleable iron in pipe flange manufacture permitted by Sched. 2, Limitation Order L-42. *(Release No. WPB-2726)*

Relax Plumbing Fixtures. (WPB)—Restrictions on use of metals in plumbing fixtures relaxed under Sched. XII to L-42 as amended, eff. Feb. 20. *(Release No. WPB-2589)*

Hardware Items Cut. (WPB)—Number of builders' finishing hardware items permitted manufactured cut from 3500 to 2200, by Sched. I of Limitation Order L-236, amended Feb. 26. *(Release No. WPB-2658)*

Equipment

Welding Equipment Prices. (OPA)—Non-electrical welding equipment including rods, wire, electrodes and supplies, covered by machinery price regulation, under Amend. 73 to MPR 136 (Machines and Parts and Machinery Service), eff. April 8. *(Release No. OPA-T-726)*

Mining Machinery Control. (WPB)—Mining equipment industry under strict wartime control, under Limitation Order L-269, issued March 11, WPB to direct scheduling of production and deliveries of mining machinery, maintenance materials, repair parts and equipment replacements. *(Release No. WPB-2812)*

Valves Standardized. (WPB)—Control valves, liquid level controllers, and pyrometers and resistance thermometers simplified and standardized by GLO L-272, issued Feb. 22. *(Release No. WPB-2628)*

Valve Limitation Adjusted. (WPB)—Limitation Order L-252 revised to exempt valves, cast or forged, before May 1, 1943. *(Release No. WPB-2697)*

Frozen Equipment Authorized. (WPB)—Provision for authorizing scheduled production of 4 types of products (typewriters, domestic and commercial laundry equipment, office equipment), whose manufacture for non-essential uses stopped, made March 12 in WPB orders L-54-c, L-91, L-54-a, and L-6-c. *(Release No. WPB-2832)*

Patterns

Clarify Shellac Order. (WPB)—Definitions and existing stock exemptions in shellac order clarified April 6 by Allocation Order M-106 as amended. *(Release No. WPB-3097)*

Safety

Safety Shoes Purchases. (OPA)—For convenience of workers who need to buy safety shoes on short notice, employers authorized to issue purchase certificates to any employee who has used ration stamp 17, under Amend 7 to Ration Order 17, eff. April 5. *(Release No. OPA-2094)*

Miscellaneous

CMP Simplification. (WPB)—To further simplify CMP procedures, new Regulation No. 7 provides single standard form of certification on any delivery order, in lieu of other forms now required by CMP Regs. 3, 4 and 5. Earlier forms may still be used if purchaser chooses. *(Release No. WPB-2681)*

CMP Procedure. (WPB)—Procedures whereby controlled materials producers will obtain materials for products established by CMP Regulation No. 8, issued March 13. *(Release No. WPB-2838)*

Simplify WPB Paper Work. (WPB)—Further extensive reduction in paper work under CMP made by WPB decision to omit Form CMP-6 on all purchase orders for controlled materials. *(Release No. WPB-2590)*

Revise Priorities Regulation. (WPB)—Amendment of Priorities Reg. 11, Feb. 20, brings all WPB definitions of maintenance, repair and operating supplies into conformity with those in CMP Reg. No. 5. *(Release No. WPB-2617)*

Consumers Accounting Manual. (WPB)—A Consumers Allotment Accounting Manual, to assist in organizing record keeping and accounting required under CMP, now available. *(Release No. WPB-2583)*

CHAPTER OFFICERS

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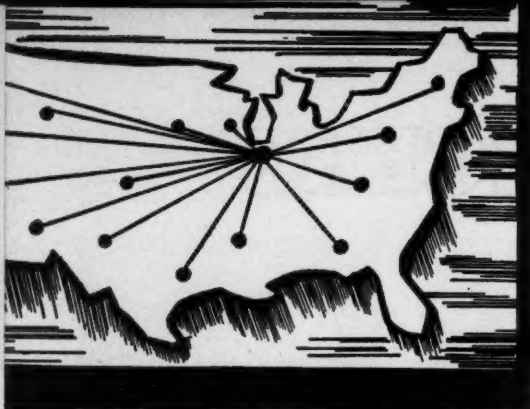

Chapter Activities

Wisconsin Chapter Stages a Night of Round-Table Talks

By Geo. M. Pendergast,* Milwaukee, Wis.

BRAVING the worst storm of the winter, a surprising attendance at the regular monthly meeting of the Wisconsin Chapter, held March 19 at Hotel Schroeder, Milwaukee, was rewarded by one of the most novel and interesting sectional sessions ever held. At the dinner session Chapter President George K. Dreher, Ampco Metal, Inc., announced that the following had been nominated as officers and directors for the coming year without opposition:

President, George K. Dreher; *Vice-President,* Harry E. Ladwig, Allis-Chalmers Mfg. Co.; *Treasurer,* R. F. Jordan, Sterling Wheelbarrow Co.; *Secretary,* John Bing, A. P. Green Fire Brick Co.; *Directors*—Oscar E. Woehlke, Grede Foundries, Inc.; Paul E. Riedel, Production Pattern Works; L. D. Harkrider, General Malleable Corp.; R. J. Anderson, Belle City Malleable Iron Co.

*George M. Pendergast & Co., and Chairman of the Wisconsin Chapter's Publicity Committee.

Talk on Pattern Needs

Before breaking up into individual round-table groups, the attendance combined to hear E. T. Kindt Jr., Kindt-Collins Co., Cleveland, discuss "Patterns and Their Relation to the Foundries." Mr. Kindt strongly urged that the pattern groups throughout the country take immediate steps for united action in impressing upon W.P.B. the acute situation confronting patternmakers in their inability to obtain restricted material for essential pattern work. He described scientifically cast pattern plates, illustrating his talk with a fine educational film.

Frank J. Waldenmeyer, Lindeman & Hoverson Co.; L. D. Harkrider, G. F. Smitka, Ampco Metal, Inc., and Walter Schmidt, Falk Corp., served as chairman and leader of the impressive discussion that followed the talk.

During the round-table sessions, Jo[illegible] A. Gitzen, Delta Oil Products Co., Milwaukee, covered core room practices in his talk on "Core Sand Binders, Their Uses and Properties" before the Non-Ferrous Group.

Because of the interest of many present in production of magnesium aircraft parts, Mr. Gitzen was besieged with a flood of questions. During this discussion he stated that the finer grain core sands have proven more satisfactory and recommended bank sands rather than silica sands for this type of work. Walter Edens, Ampco Metal, Inc., and A. K. Higgins, Allis-Chalmers Mfg. Co., served as chairmen of this group.

The Steel section held an absorbing discussion of some topics that highlighted the recent regional foundry conference sponsored by the Wisconsin Chapter. Leading the discussion were Carl Haertel and Fred Pritzlaff,

Splendid attendance marked the 6th regional foundry conference sponsored by the Wisconsin Chapter of A.F.A., February 18-19 at Milwaukee. Among the personalities observed at the opening-day luncheon were (Top row left, left to right): Chapter Secretary Harry Ladwig, Allis-Chalmers Mfg. Co.; W. A. Hambley, Allis-Chalmers, Chairman of the regional conference; Dr. C. A. Dykstra, president of the University of Wisconsin, who delivered the keynote address; Prof. J. F. Oesterle, University of Wisconsin, Associate Chairman of the conference; and Chapter Chairman George K. Dreher, Ampco Metal, Inc.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)

Falk Corp.; Jas. J. Ewens, Milwaukee Steel Foundry Co.; Paul C. Power, Maynard Electric Steel Casting Co., and David Zuege, Sivyer Steel Casting Co.

Max Kuniansky Speaks at Central Indiana

By R. A. Thompson,* Indianapolis

THE important subject of "Today's Cupola Operation and Scrap," presented by an authoritative guest speaker, drew nearly 100 members and guests to the regular technical meeting of the Central Indiana Chapter, held April [illegible] at the Washington Hotel, Indianapolis, Ind. Principal speaker was Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., who was introduced by Chapter Chairman B. P. Mulcahy, Citizens Gas & Coke Utility, Indianapolis. J. P. Lentz, International Harvester Co., presided over the technical meeting.

Mr. Kuniansky, well known for his many contributions to the subject of better cupola practice, discussed the manner in which metal is melted in his plant. His talk, and the lively question period that followed, proved extremely helpful to those who attended.

*Electric Steel Castings Co., and Secretary of the Central Indiana Chapter.

W. New York Holds a Non-Ferrous Meeting

By J. R. Turner,† Buffalo, N. Y.

NINETY members and guests of the Western New York Chapter turned out for the regular monthly meeting on April 2, at Hotel Touraine, Buffalo. Chapter Chairman R. T. Rycroft, Jewell Alloy & Malleable Co., Inc., Buffalo, presided over the evening, which was devoted to non-ferrous castings problems. At the dinner session he introduced A.F.A. National President D. P. Forbes, Gunite Foundries Corp., Rockford, Ill., who spoke briefly on the St. Louis Foundry Congress.

Three speakers featured the technical meeting, the first being H. R. King, Metal & Alloy Specialties Co. Inc., Buffalo, on "Bronze Casting Alloys." Mr. King described mixtures and alloys of bronze and brass castings, including tin bronze, the red, and yellow groups, bearing and packing metals, and the alloyed groups including alumina, silica, monel and nickel bronzes and white metals.

Milton H. Berns, Electro Refractories & Alloys Corp., Buffalo, speaking on the "Manufacture and Uses of Crucibles," offered many pointers on the care of crucibles so as to prolong their life in wartime. He also reviewed the various types of crucible furnaces with the use of slides.

The third speaker, Crary Davis of American Magnesium Corp., Buffalo, described the various alloys used in "Magnesium Foundry Practice." He discussed their utility in terms of the characteristics of magnesium castings. Sand practice, he stated, calls for a highly permeable synthetic sand for both cores and molds, and stressed gating as a measure for obtaining sound, clean castings. The method of melting and pouring the metal was dealt with, as well as heat treating and cleaning of magnesium castings.

Following the talks a motion picture on "Aluminum, Mine to Metal and Fabricating Processes" was presented through courtesy of the Aluminum Co. of America.

†Queen City Sand & Supply Co., and Acting Secretary, the Western New York Chapter of the Association.

Inoculation Subject of Western Michigan

By K. C. McCready,** Sparta, Mich.

SOME 66 members and guests enjoyed a fine turkey dinner at the Ferry Hotel, Grand Haven, Mich., when the Western Michigan Chapter held its March 8 meeting. Thomas Barlow, Vanadium Corp. of America, Detroit, gave the guest lecture of the evening, on the interesting subject of "Inoculation."

Mr. Barlow offered numerous photomicrographs in pointing out the fact that so-called modified iron is improved by inoculation. One point stressed was the important one of having sufficient amount of the inoculate to do the job desired under varying every-day conditions, the maximum amount needed always being used. General discussion followed the talk.

Added entertainment was offered by a local magician, O. T. Gylleck, who displayed some bewildering tricks of magic and sleight-of-hand.

**Muskegon Piston Ring Co., and Secretary of the Western Michigan Chapter.

Climax of the 11th Annual Regional Conference sponsored by the Birmingham District Chapter, February 19, was the annual banquet at which E. L. Shaner, Penton Publishing Co., Cleveland, was the main speaker. Top, left to right—Mr. Shaner, and Chapter Chairman E. A. Thomas, Thomas Foundries, Inc. Bottom, left to right—J. A. Woody, American Cast Iron Pipe Co., Chapter Director; and Director A. S. Holberg, Alabama City Products Co.

Record Attendance at Twin City Meeting

By O. W. Potter,†† Minneapolis, Minn.

DRAWN by the dual attraction of an excellent guest speaker, Pat Dwyer of *The Foundry*, Cleveland, and the chapter's annual elections, the Twin City Chapter chalked up a record attendance of 112 at the March 22 meeting, held at the Midway Club, St. Paul, Minn. Chapter Chairman R. M. Aker, Western Alloyed Steel Casting Co., presided, introducing several guests, including W. A. Hambley, Allis-Chalmers Mfg. Co., Milwaukee.

††University of Minnesota, and Secretary-Treasurer of the Twin City Chapter of the Association.

Chapter officers and directors, and guest speaker, at the March 19 meeting of the Eastern Canada and Newfoundland Chapter, in Montreal. Left to right—Vice-Chairman M. L. Doelman, Electric Steels Ltd., Andrew Reyburn of the Merchant Shipping Board, guest speaker; Chapter Chairman C. C. Brisbois, Robert Mitchell Co. Ltd.; Harold J. Roast, Canadian Bronze Co. Ltd., and National Director of A.F.A.; R. E. Cameron, Chapter Asst. Secretary; and R. W. Bartram, Robert W. Bartram Ltd., Honorary Chairman.

Chairman Akers presided over the chapter's annual election, at which R. W. Bingham, American Hoist & Derrick Co., St. Paul, was chosen as *Chairman* for the year 1943-1944; C. H. Anderson, Crown Iron Works, Minneapolis, was elected *Vice-Chairman,* and A. S. Caswell, Minneapolis Civic & Commerce Association, *Secretary-Treasurer;* new *Directors*—Fulton Holtby, University of Minnesota, Minneapolis; Jos. Garske, Progress Pattern & Foundry Co., St. Paul; A. F. Carlstrom, Smith Sharpe Co., Minneapolis.

Pat Dwyer's talk, dealing with his favorite subject of "Gates and Risers" in his inimitable way, was most instructive and entertaining.

At the outset, those who had not made advance reservations were asked to contribute to the Red Cross as a penalty. However, when the contributions were counted it was found that everyone present had chipped in, the sum of $21.42 being turned over to the Red Cross.

Alloyed Cast Irons N. California Subject

By Geo. L. Kennard,* San Francisco

MEMBERS of the Northern California Chapter held their regular monthly meeting March 12 at the Athens Club, Oakland, with total attendance of approximately 70. Chapter Chairman F. A. Mainzer, Pacific Brass Foundry of San Francisco, presided during dinner, after which Vice-Chairman Harry Bossi, H. C. Macaulay Foundry Co., took over and conducted the meeting.

Albert G. Zima, International Nickel Co., past-chairman of the Southern California Chapter of A.F.A. and guest speaker of the evening, was introduced by Program Chairman Serge P. Kovaleff, Enterprise Engine & Foundry Co. Serge stated that "Al" Zima needed little introduction to the chapter, being nationally known for his activities.

Mr. Zima discussed "Alloyed Cast Irons" with the aid of slides and blackboard, presenting first a brief outline of the part such irons have played during the past few years. He described steps taken to control critical materials, pointing out the possibilities of obtaining satisfactory results by following the suggestions of those in authority, who are constantly striving to keep up quality of products and at the same time conserve supplies of raw materials throughout the war's duration.

*Northern California Foundrymen's Institute, and Secretary-Treasurer of A.F.A.'s Northern California Chapter.

Cooperation Stressed at E. Canada Meeting

By Wm. J. Brown,† Montreal, Que.

ENTHUSIASM in the "baby" chapter was well maintained at the March 19 meeting of the Eastern Canada and Newfoundland Chapter. Chairman C. C. Brisbois, Robert Mitchell Co. Ltd., presiding, stated that the chapter now has 166 members, with good prospects of reaching a goal of 200 before the end of the first season.

The meeting was addressed by Andrew Reyburn, supervisor of all castings orders and deliveries for the wartime Merchant Shipping Board. A new chapter member, Mr. Reyburn was connected with the Canadian National Railways for 24 years as pattern shop foreman, and foundry superintendent. His subject was "Cooperation Between the Pattern Shop and the Foundry in the Production of Castings."

Mr. Reyburn stressed the importance of the engineer or customer first contacting the foundry with the casting problem, followed by the absolute necessity of closest collaboration between pattern shop and foundry, regardless of whether the pattern shop is a job shop or part of the foundry itself.

The speaker emphasized the ever-increasing need for educat-

†Robert W. Bartram, Ltd., Reporting for the Eastern Canada and Newfoundland Chapter of the Association.

A main highlight of the Wisconsin regional conference, sponsored by the Wisconsin Chapter of A.F.A., was the official banquet held the evening of February 18 at Hotel Schroeder, Milwaukee. Fully 700 were served at this mammoth affair, which was addressed by Maj. Gen. Stephen O. Fuqua, retired, and by C. E. Westover, Executive Vice-President of A.F.A.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)

Evidence that John Bing's ever-present camera really "got around" at the Wisconsin Chapter's 6th regional foundry conference in Milwaukee, February 18-19. Representatives from many plants in the area swelled the attendance, and found an excellent program awaiting them . . . one of the most important in the six-year history of this major event.

ing molders and apprentices in mechanical drawing, toward a more general knowledge of all that goes into a first-class casting. Only in this way, he said, can men be trained to fill the gaps left by retirement of older men. Numerous questions followed presentation of Mr. Reyburn's paper.

Coremaking Problems Topic of New England Foundrymen

By M. A. Hosmer,* Boston, Mass.

"PROBLEMS in the Manufacture of Cores" occupied the attention of 110 members and guests of the New England Foundrymen's Association at their regular monthly meeting March 10, at the Engineers Club, Boston. A. W. Calder, New England Butt Co., Providence, R. I., and newly elected president of the group, presided and introduced the guest speaker, L. P. Robinson, Werner G. Smith Co.

Mr. Robinson particularly stressed proper baking of cores, as one of the most important of coremaking processes. Thermocouples and pyrometers should be checked and cleaned regularly, and their accuracy checked against a standard thermometer. Most cores, he said, should be baked from 400° to 425°F., no benefit deriving from higher temperatures.

If a core comes out of the oven smelling of core oil, it is pretty good proof of improper oxidization of the oil, and moisture in the center of such a core will not be eliminated by rebaking. The extra heating will darken the core surface but the moisture in the center will be prevented from escaping by the oxidized film on the outside.

Mr. Robinson stated that in a majority of cases the real oil ratio is unknown. The ratio should be checked regularly, and to insure highest accuracy it is better to weigh the oil rather than measure it. When cereal binder is used, he said that the binder should be added first, then water, then oil, the correct order of addition insuring greater tensile strength. Summing up, he particularly stressed uniform practice.

Mr. Robinson called attention to the A.F.A. Cupola Research Project, and urged the cooperation of all foundrymen in promoting the welfare of the industry. Following his talk a number of questions were asked from the floor, promoting a lively discussion period.

*Hunt-Spiller Mfg. Co., and Reporter for the New England Foundrymen's Association.

C. E. Westover Talks to Chesapeake Group

By F. G. Bruggman,* Baltimore, Md.

CHESAPEAKE Chapter held its regular monthly meeting February 23 at the Engineers Club, Baltimore, with Chapter Chairman J. E. Crown, U. S. Navy Yard, Washington, D. C., presiding. C. E. Westover, Executive Vice President of A.F.A., Chicago, was the guest speaker of the evening and spoke of the necessity for the A.F.A. as a means of bringing local foundry-

*Industrial Supply Corp., and Reporter for the Chesapeake Chapter of A.F.A.

men together to discuss their mutual problems, help each other to improve conditions in their foundries and ultimately improve the products they make. He pointed out that the Association as a whole has achieved great success nationally along these lines, and has developed many ideas and processes helpful to the industry.

Following Mr. Westover's talk a series of round-table discussion groups convened. E. C. Troy, Dodge Steel Co., Philadelphia, presided over the steel discussions. Wally Levi, Lynchburg Foundry Co., Lynchburg, Va., was the leader of the gray iron round-table. John Cochrane, Cochrane Brass Foundry, York, Pa., headed the table on nonferrous castings.

The discussions proved most interesting to the members present and all were well attended.

New Officers Elected by Central Indiana

NEW officers and directors of the Central Indiana Chapter were elected for 1943-44 at the chapter's April 5 meeting, Richard H. Bancroft, Perfect Circle Co., New Castle, Ind., being selected as *Chairman.* Harold H. Lurie, Cummins Engine Co., Columbus, Ind., was elected *Vice-Chairman;* Wm. Zeunik, National Malleable & Steel Castings Co., Indianapolis, *Treasurer;* and Robert Langsenkamp, Langsenkamp-Wheeler Brass Works, Indianapolis, *Secretary.*

New *Directors-elect,* whose terms of office will expire in 1946, are as follows: R. S. Davis, National Malleable & Steel Castings Co., Indianapolis; Chas. J. Gisler, C. & G. Foundry & Pattern Works, Indianapolis; Reid L. Palmer, Federal Foundry Co., Indianapolis; and retiring Chairman B. P. Mulcahy, Citizens Gas & Coke Utility, Indianapolis. In addition, Eugene Smith, Eugene Smith Sand Co., Indianapolis, was elected director to replace H. H. Lurie on the board, in view of the latter's election to the office of Vice-Chairman.

Movie Night Featured by Cincinnati Chapter

By Henry M. Wood,* Cincinnati

SIXTY members and guests of the Cincinnati Chapter were treated to an interesting presentation of technical subjects at their regular monthly meeting, held April 12 at the Cincinnati Club. Chairman Frank Hutchinson, Reliance Foundry Co., presided, the program of moving pictures being introduced by Program Chairman Ed H. King, Hill & Griffith Co.

A silent film on "Cupola Charging" was offered by P. E. Anderson, Harnischfeger Corp., Milwaukee, Wis., which proved most interesting. A second film, entitled "Unfinished Rainbows," offered through courtesy of the Aluminum Co. of America, depicted advancements in production and increased use of aluminum.

Chairman Hutchinson appointed Wm. Ball Jr., Edna Brass Mfg. Co., chairman of the nominating committee to present nominations for officers and directors for the coming year at the May 10 meeting.

*W. W. Sly Mfg. Co., and Secretary of the Cincinnati Chapter of A.F.A.

Chicago Elects New Officers at Museum of Science and Industry

By F. E. Wartgow,† E. Chicago, Ind.

A RECORD turn-out and an exceptionally high caliber attendance featured the April 5 meeting of the Chicago Chapter of A.F.A., drawn by the election of new officers and directors and the announced conducted tour of the fascinating Museum of Science and Industry. Reservations for dinner, served at the Museum, were not only filled, but fully 75 were turned away, joining the group later for the tour.

Chapter Chairman A. C. Gierach, American Manganese Steel Div., Chicago Heights, Ill., presided at the dinner. Speakers included C. E. Westover, Executive Vice-President of A.F.A., Chicago; Maj. Lenox R. Lohr, President of the Museum; D. P. Forbes, Gunite Foundries Corp., Rockford, Ill., and National President of A.F.A., and A. S. Klopf, Hansell-Elcock Co., Chicago, a Director of the Chapter.

New Officers Elected

Prior to the tour the slate of officers and directors for 1943-44 as prepared by the Nominating Committee was presented, and unanimously elected. M. F. Becker, Whiting Corp., Harvey, Ill., was elected *Chairman* of the Chapter; A. S. Klopf, *Vice-Chairman;* Frank E. Wartgow, *Secretary;* C. C. Kawin, C. C. Kawin Co., *Treasurer;* new *Directors*—retiring Chairman A. G. Gierach; Chester K. Faunt, Christensen & Olsen Foundry Co.; D. H. Lucas, Sales Representative; H. K. Swanson, Swanson Pattern & Model Works; Wm. L. Hartley, Link-Belt Co.

The tour, conducted in groups of 35, took over two hours to complete, and included many of the most worth-while features of the Museum. Some time was spent at the exhibit of a model foundry in actual operation, a project originally sponsored by the American Foundrymen's Association, and now under sponsorship of the Chicago Chapter.

†American Steel Foundries, and Secretary of Chicago Chapter.

Reichert Addresses Metropolitan Group

By R. E. Ward,** Bendix, N. J.

THE vital importance of control to quality castings was emphasized at the April 5 meeting of the Metropolitan Chapter of A.F.A., held at Essex House, Newark, N. J., by W. G. Reichert, W. G. Reichert Engineering Co., New York. Mr. Reichert, the guest speaker of the evening, was introduced by W. E. Martin, Sperry Gyroscope

**Eclipse Aviation Div., Bendix Aviation Corp., and Chairman of Publicity Committee, Metropolitan Chapter.

Co., acting as Technical Chairman.

The speaker pointed out that good quality castings can be obtained only through proper control of all phases of foundry manufacture. Castings should be designed properly before being submitted to the foundry, and since a casting is no better than the pattern from which it is made, special attention should be given pattern design and equipment. Sand control, metal control and a scientific approach to all phases of foundry operations, Mr. Reichert said, are requirements that must be recognized if the final product is to be of the highest quality.

N.E.O. Stages Another Popular Quiz Program

By Edwin Bremer,* Cleveland

OVER 150 members and guests attended the regular April 8 meeting of the Northeastern Ohio Chapter, at the Cleveland Club, Cleveland, proving their interest in the quiz type program first presented so successfully in January. Chapter President J. H. Tressler, Hickman Williams & Co., presided.

Prior to the technical meeting Frank J. Dost, Sterling Foundry Co., Wellington, Ohio, reported as Chairman of the Nominating Committee the following nominations for officers and directors, to be voted on in May.

For President—J. G. Goldie, Cleveland Trade School; *for Vice-President* — R. F. Lincoln, Osborn Mfg. Co.; *for Treasurer* —F. R. Fleig, Smith Facing & Supply Co.; *for Secretary*—J. M. Lathrop, *The Foundry.*

For Directors (3 year term)—J. B. Heisler, A. C. Williams Co., Ravenna; H. O. Gollmar, Elyria Foundry Co., Elyria; Bruce Aiken, Crucible Steel Casting Co.; H. F. Roberts, Williams & Co.; H. J. Trenkamp Jr., Ohio Foundry Co.

For Director (1 year term)—G. B. Carson, Case School of Applied Science. In accordance with the by-laws, retiring President Tressler also will serve on the board of directors.

Several short news reels were shown through courtesy of A. C. Denison, Fulton Foundry & Machine Co., with the explanation that such films are shown his plant employees twice a day because long work hours prevent the men from attending movie theaters. He stated that the films had proved good morale builders.

Broad Quiz Subjects

A panel of nine experts took over the answering of questions on a wide range of subjects, the nine including: Bruce Aiken, Frank Dost, A. C. Denison; R. Bryson, American Magnesium Corp.; Pat Dwyer, *The Foundry;* V. J. Sedlon, Mastern Patterns Co.; E. M. Gingerich, Aluminum Co. of America; Carl Beattie, Lake City Malleable Co., and E. F. Hess, Ohio Injector Co.

Among the many questions asked, some of the most interesting involved patching procedure on cupolas, non-shrinking pattern metal, proper amount of core oil for heavy gray iron, temperature at which magnesium alloys ignite, core washes for malleable iron, air pressure for blowing cores, advantages and disadvantages of aluminum-copper and aluminum-silicon alloys, variations in gating and risering on similar steel castings.

*The Foundry, and Chairman of Publicity for the Northeastern Ohio Chapter of A.F.A.

Ontario Group Hears About Metal Control

By G. L. White,† Toronto, Ont.

"CONTROL of Non-Ferrous Metals" was discussed at the February 26 meeting of the Ontario Chapter of A.F.A., held at Toronto, by guest speaker A. C. Boak, Chief of the Substitutions and Specifications Section, Office of Metals Controller, Dept. of Munitions and Supply, Ottawa. Preceding Mr. Boak's talk, two films were shown through courtesy of the National Film Board of Canada, depicting phases in the search for metals, their production and application in the war program.

The speaker outlined steps taken to place limitations on the use of tin, tinplate and the production of solder, babbitt and bronze. He stated that through cooperation of the armed services by altering specifications to utilize silicon bronze, manganese bronze and lower tin bronzes, thousands of pounds of tin have been saved. Other orders of the Metals Controller on tin conservation were outlined, including compulsory segregation of scrap by analysis of original material, and shipment of tin-bearing scrap direct from foundries to ingot producers.

†Canadian Metals and Metallurgical Industries, and Secretary of the Ontario Chapter.

Did You Get It? Have You Read It? How Did You Like It?

Well in advance of the St. Louis Foundry Congress, 10,000 copies of the April Pre-Convention Issue of "American Foundryman" went into the mails. At least one copy was received by every company in the United States and Canada operating a foundry, both "captive" and jobbing, and both Member and Non-Member organizations. Thus the entire Foundry Industry of North America has been made acquainted with this, the most ambitious issue of "American Foundryman" ever published.

What did YOU, as an A.F.A. Member, think of this big Pre-Convention number . . . with its complete story on the 2nd War Production Foundry Congress, the technical and practical articles, the news of Committee and Chapter Activities and, lastly, the extensive Advertising Section and Buyers Guide. Member comments will be appreciated. Please send them to the Editor, "American Foundryman," 222 West Adams St., Chicago, Illinois.

Abstracts

NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman,* from current technical and trade publications.

When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th Street, New York, N. Y.

Alloys

BORON IN STEEL. *(See Steel.)*

Babbitting

CAST IRON. *(See Cast Iron.)*

Boron

STEEL ALLOY. *(See Steel.)*

Brass and Bronze

DOWN-GRADING. *(See Non-Ferrous.)*

Briquetting

TURNINGS AND BORINGS. *(See Scrap.)*

Carbon Determination

CAST IRON AND STEEL. *"Determines Carbon in Cast Iron and Steel,"* J. G. Donaldson, *The Foundry,* vol. 71, No. 3, March, 1943, pp. 117-118. The author describes a direct method of determining the combined carbon content of cast iron or steel. The determination, which takes about 15 minutes, is made by dissolving the sample in a dilute nitric-sulphuric-phosphoric acid mixture containing a small amount of silver nitrate as a catalyst, boiling with a hot solution of ammonium persulphate to oxidize the combined carbon, passing the evolved gases over heated copper oxide, removing sulphurous gases and moisture, and absorbing and weighing the evolved carbon dioxide. The author describes the apparatus used, the size of sample and amount of chemicals used, the working technique, and applications of the method.

Cast Iron

BABBITTING. *"Babbitting of Cast Iron Improved by New Process," Product Engineering,* vol. 14, No. 4, April, 1943, pp. 228-230. The newly developed Kolene process for cleaning and tinning either cast iron or steel permits subsequent babbitting with a good bond between the babbitt and base metal. The process consists of dipping the part to be babbitted in four baths in the following order: (1) Molten oxidizing salts at 800°F.; (2) a mixture of water-soluble reducing salts at 270°F.; (3) dilute hydrochloric acid; and (4) a tinning bath composed of 90 per cent lead, not more than 5 per cent tin, and enough antimony to give a low surface tension. When babbitt is applied to surfaces thus prepared, the bond is of greater strength than the babbitt lining. Surface graphite is oxidized without exposing more graphite, and the pockets left by the graphite are filled with the tinning alloy. Use of this process makes possible the design of smaller bearings, for both the babbitt lining and the metal backing may be made thinner. Anchor holes or grooves are unnecessary.

CARBON DETERMINATION. *(See Carbon Determination.)*

FLUIDITY. *"Factors Influencing the Fluidity of Cast Iron,"* G. Burgess, *Foundry Trade Journal,* vol. 69, No. 1386, March 11, 1943, pp. 197-204. The information in this article was first presented before Sheffield Branch, Inst. of British Foundrymen in 1921, in paper by Desch, *"The Fluidity of Molten Metals."* Fluidity of cast iron depends on temperature, composition, amount of oxide skin and viscosity. Of these factors temperature is most important. Above the freezing point, fluidity decreases as temperature decreases. Very small differences in composition may greatly affect fluidity. It is believed that the greatest fluidity exists at the eutectic composition, with regard to carbon content. The state of the carbon has some effect, an iron with high graphitic carbon being less fluid than one with low graphitic carbon. On other hand, low carbon irons have poor fluidity. Silicon probably improves fluidity by affecting the carbon eutectic composition. Phosphorus lowers the freezing point of iron, and thus improves fluidity. Increasing amounts of oxide film apparently decrease fluidity. Viscosity has a bearing on fluidity, but the experimentors assumed it to be constant in studying the other factors affecting fluidity. The author describes the melting, temperature determining, alloying and pouring procedures for fluidity tests upon which the foregoing conclusions were based. Discussion of paper follows.

HIGH TEST. *"High Test Iron Production Is Not Difficult,"* A. P. Alexander, *The Foundry,* vol. 71, No. 3, March, 1943, pp. 92-94, 181-185. High-test irons are generally of such a composition that if a graphitizer such as silicon or nickel were not added at the spout of the cupola, they would solidify as white iron. High-test irons having from 50,000 to 60,000 lb. per sq. in. tensile strength are produced without difficulty, provided the variables of cupola operation are carefully checked and controlled. A coke bed of the proper height should be correctly prepared. Charges should be of correct analysis, carefully calculated, and properly positioned in the cupola. Graphitizers should be added at the spout, rather than in the ladle. Before pouring, wedge tests should be made to check the composition, and the metal should be poured hot.

LOST WAX CASTING. *(See Lost Wax Process.)*

PISTON RINGS. *"Make Piston Rings for War Machines,"* Pat Dwyer, *The Foundry,* vol. 71, No. 3, March, 1943, pp. 88-91, 179. The author describes the molding practice, melting practice and materials handling methods used in producing gray cast iron piston rings in the foundry of Perfect Circle Co., Hagerstown, Ind.

REPLACING FORGINGS. *"Iron Castings Replace Forgings for Highly Stressed Parts," Product Engineering,* vol. 14, No. 3, March 1943, pp. 161-164. Limitations on forging facilities have greatly stimulated the substitution of cast iron for forged steel in highly stressed machine members. The lower notch sensitivity and greater vibration dampening capacity of cast iron have made these substitutions equal or superior in fatigue service to the original forged products. Furthermore, economies have frequently resulted from the substitutions. Design changes necessary for substitutions are usually slight. Undoubtedly many of these substitutions will continue to be used after forging facilities are again available. The author gives drawings and descriptions of a refrigerator crankshaft, compressor crankshaft, compressor crosshead, and a main bearing shell which, formerly forged of steel, now are made of cast iron. The drawings show design changes which were made.

SCRAP BRIQUETS. *(See Scrap.)*

Centrifugal Castings

WAR PRODUCTION. *"Castings for War Equipment,"* G. L. White, *Canadian Metals and Metallurgical Industries,* March 1943, pp. 16-19. The author sketches the layout of the foundry of Ford Motor Co. of Canada at Windsor, Ontario, and briefly describes its products which include crankshafts, hubs, brackets, and universal carrier treads. He also discusses in detail the application of centrifugal casting methods to the production of airplane cylinder liners, egg-cup castings which are used in the front wheel drive of some vehicles, and other miscellaneous small castings being produced in clusters. The cylinder liner is strictly a centrifugal job spun at high speed. The egg-cup castings are produced in permanent molds spun at low speeds. The series of cluster castings are made in sand molds clamped together and spun in spinning pots at a relatively low speed. The number of castings which may be spun in a cluster is determined by mechanical limitations.

Cores

COATINGS. *(See Molds.)*

Core Baking

CORE OVENS. *"Core Making and the Selection of Proper Core Baking Equipment: Part II,"* F. H. Faber, *Industrial*

Heating, vol. 10, No. 1, January, 1943, pp. 84-90. Modern types of core baking ovens speed up production and insure properly baked cores. Some types employ a cross flow system of heating coupled with recirculation, which hastens drying, effects fuel economies, and maintains uniform conditions throughout the oven. The author describes two types of modern core ovens, the simplest of which is the shelf type oven. The proper volume of air is heated outside the oven chamber, supplied to and circulated through the oven, and recirculated by means of a large fan. Heated air flows from the fan outlet into a heat duct which extends along one side of the oven, through ports with controllable dampers, across the shelves, and into a recirculating duct similar to the heat duct and extending along the opposite side of the oven. The air is reheated before it is recirculated. A second type of oven is the rolling-drawer type, in which the shelves of the shelf type oven are replaced with rolling drawers. This type of oven is more flexible, allowing easy access to the individual drawers without lowering the temperature of the rest of the oven.

Coremaking

OVEN SELECTION. *"Core Making and the Selection of Proper Core Baking Equipment—Part II,"* F. H. Faber, *Industrial Heating,* vol. 10, No. 2, February, 1943, pp. 242-250, 254. Large modern core ovens may be designed to facilitate their loading and unloading, to provide large capacity in a limited space, or to be used for various heat treating operations as well as core baking. Portable rack or truck loaded ovens permit the loading or unloading of one rack or truck while another is in the oven. Monorail loaded ovens are similar except that cores are loaded on carriers suspended from overhead track. The elevated type continuous conveyor oven bakes cores as they move through the oven during one or more passes. Much of the oven is overhead, and therefore floor space is conserved. The tower type oven, in which a continuous conveyor moves vertically, uses a minimum of floor space. Combination ovens which may be used for stress relieving cast iron and heat treating nonferrous parts, as well as baking cores, are provided with dual burners to provide the temperatures necessary for both the core baking and heat treating operations.

Flame Hardening

STEEL. *(See Steel.)*

Fluidity

(See Cast Iron.)

Forgings, Steel

CAST IRON REPLACEMENTS. *(See Cast Iron.)*

Furnaces

OPEN-HEARTH. *(See Steel.)*

Hardening

STEEL. *(See Steel.)*

High-Test Cast Iron

PRODUCTION. *(See Cast Iron.)*

Lost Wax Process

PRECISION CASTING. *"Precision Castings,"* W. A. Phair, *Iron Age,* vol. 150, No. 2, July 9, 1942, pp. 39-41. A method of producing castings to unusually close tolerances is described, by a new method combining the so-called lost wax process, a new type of highly refractory material in place of sand, and centrifugal casting. Castings are being produced in aluminum, bronze, beryllium copper, cast iron, carbon steel, stainless steel and several other alloy analyses to tolerances of 0.001 in. on all surfaces. Some small pieces have been cast with tolerances up to 0.0005 in. in all directions. In making a casting by this method the master pattern usually is developed from a stock sample of the part. The master pattern combines both pattern and mold, with removable sections for undercuts or cored sections. The master mold forms the wax core or pattern, each mold having its own pattern, the wax form then being placed in a cylindrical flask and the liquid refractory material poured in. The mold then is baked, the wax melting and running out, the flask then being ready for pouring. Key points in the process are the wax and the refractory. No information is given on the wax composition. The refractory material is very fine, passing through a 340 mesh, composition being adjustable to suit the type of metal being poured. The method is finding use in making many small parts, in many cases as part of an assembly without any further machining.

Magnesium

HEALTH HAZARDS. *(See Safety and Hygiene.)*

Magnesium Castings

(See Non-Ferrous.)

Manganese Bronze

(See Non-Ferrous.)

Metallography

STEEL. *(See Steel.)*

Molds

COATINGS. *"Core and Mold Castings,"* Dr. J. A. Ridderhof, *Canadian Metals and Metallurgical Industries,* vol. 5, No. 11, November 1942, pp. 327-331. Paper presented before Ontario Chapter, American Foundrymen's Assn. The subject of core and mold coatings has received much less attention than other foundry phases. Coatings include core wash, blacking, plumbago and numerous special sprays and shake-ons, all having one purpose, improvement of castings surfaces. Factual data are given on composition of coatings, carrier liquids, mixing, consistency and control, application, drying, nature of coatings, choice of type, defects, and specific applications in aluminum and steel work. The ideal coating material is one that is easy to apply, gives proper penetration and thickness of surface film to prevent fusion of sand or metal, does not run, flattens out on drying to a smooth surface, does not cause metal turbulence, is not washed off in pouring, and does not give off enough gas to cause blows. Depth of penetration and thickness of coating are important. Regardless of a coating's high quality it will not correct poor sand, but may help correct such defects as roughness, sand fusion and cutting by the metal. Plumbago adheres better to sand on the wet side, and adheres better to coarse sand than fine sand.

Molding Substitutes

STEEL CASTINGS. *(See Steel.)*

Non-Ferrous

DOWN-GRADING BRASS AND BRONZE. *"Using Lower Grades of Brass and Bronze Castings,"* Carter S. Cole, *The Foundry,* vol. 71, No. 3, March, 1943, pp. 87, 168. This article calls to the attention of designers the following ways in which specifications have been revised to permit the use of lower grades of bronze for castings: (1) Requirements for virgin metals have been removed; (2) impurity limits have been raised; (3) specifications have been rewritten to take advantage of currently available material. Included in the article are charts on down-grading of bronze castings and conforming specifications for bronze alloys.

LOST WAX CASTING. *(See Lost Wax Process.)*

MAGNESIUM CASTINGS. *"Producing Magnesium Castings,"* Edwin Bremer, *The Foundry,* vol. 71, No. 3, March 1943, pp. 82-85, 177-178. All operations in the production of magnesium castings are performed so as to eliminate, insofar as possible, reaction of magnesium with moisture and oxygen, and introduction of oxides into the molten metal. The American Magnesium Corp., Buffalo, uses one synthetic sand for all types of castings. Their molding sand mix consists of a base of sharp, washed silica sand, 3 per cent bentonite, 3 to 3½ per cent water, and an inhibitor. Four standard core mixes, made of the same silicon sand base with various types and amounts of binders and inhibitors, are used for cores requiring different strength properties and hardness. Chills of cast iron are liberally used both in molds and cores. Gating is designed to reduce turbulence to a minimum. Bottom or two-level gating, numerous gates, and extended runners are used. The cross-sectional area of the runners and gates is greater than that of the sprue. Steel pouring basins are always used. Castings are made in production only after satisfactory pilot castings have been obtained. Cleaning includes knocking-out, abrasive blasting, sawing off gates and risers, rough chipping, snagging, and inspections. If heat treatment is desired, it is given after cleaning. Castings then are finished to provide smooth surfaces and remove stress raisers, and are given a dichromatic dip to improve corrosion resistance.

MANGANESE BRONZE. *"Production and Properties of Cast Manganese Bronze,"* C. A. Timms, *The Metal Industry* (London), vol. 62, No. 4, Jan. 22, 1943, pp. 50-52. The entire wide range of physical properties available in manganese bronzes can be obtained with only slight variations in the amounts of aluminum, manganese and iron in a basic 58-42 brass. Of these elements, aluminum is the principal hardening alloy. Manganese both hardens and imparts a fibrous structure. The effect of iron is similar but less marked. The 58-42 brass is a 2-phase alloy containing approximately 40 per cent Alpha solution and 60 per cent Beta solution. Added hardening elements replacing zinc should strengthen the two solutions but should not change the volume ratio of Alpha to Beta. The amount of alloying elements which may be thus added may be determined using Guillet's theorem of zinc equivalence as a rough guide. The author tabulates physical properties and chemical compositions of several manganese bronzes and discusses at some length the alloy consisting entirely of the Beta constituent.

Non-Ferrous

SILICON BRONZE. *"Silicon Bronze Castings,"* Ely Poutman, *Metals and Alloys,* vol. 17, No. 3, March 1943, pp. 528-532. The author describes experiments performed to determine the correct melting procedures and physical properties of silicon bronze castings made both from pre-alloyed ingots and with hardeners, melting in a high frequency coreless induction furnace. He describes the molding practice used for all tests, the unsuccessful preliminary experiments, and the successful procedures finally adopted by his company. He also discusses machinability, corrosion, and other problems encountered in the manufacture and use of silicon bronze castings.

Open-Hearth Furnace

BOTTOM REPAIRS. *(See Steel.)*

REFRACTORIES. *(See Steel.)*

Patternmaking

LUMBER. *"Lumber for Patternmakers,"* E. T. Kindt, *The Foundry,* vol. 71, No. 3, March, 1943, pp. 159-163. The author describes the various kinds of lumber used in pattern shops and foundries, the processes whereby they are cured, the standards by which they are graded, and the effects of improper humidity in the pattern shop on the condition of the lumber when used.

Piston Rings

CAST IRON. *(See Cast Iron.)*

Refractories

INSULATING MATERIALS. *"High Temperature Heat Insulation,"* G. W. Paterson, *Canadian Metals and Metallurgical Industries,* vol 6, No. 1, January, 1943, pp. 6-11. Correct application of high-temperature materials to furnaces and ovens can effect savings through reduction in fuel consumption, elimination of air infiltration, prevention of spalling losses from silica brick, reduction in slag pocket accumulations, reduction in time for production of heats, and/or combinations of the foregoing results of better insulation. Insulating materials prevent or reduce the transfer of heat from one point to another. There are two types of high-temperature insulating materials: "light-weight" insulation and "refractory" insulation. Lightweight materials have very low heat conductivities and are suitable for use as backings for refractories up to 1600° F. Vermiculite-, diatomaceous-earth-, 85 per cent magnesia-, or mineral-wool-base materials are representative light-weight insulating materials. They may be applied in loose fill, plastic insulation, insulating concrete, or block form. Refractory insulation is suitable for use in direct contact with open flames and at temperatures up to 3000° F. Generally they are made by mixing some combustible material of the desired grain size, such as sawdust, with clay, and firing the mixture to burn out or volatilize the combustible material. This leaves a porous refractory material. Heat conductivities of refractory insulating materials are lower than those of lightweight insulating materials. Refractory coatings or joining cements may be used to prolong the life of refractory insulating materials by protecting them against mechanical abuse and penetration of destructive fuel elements. When planning the use of insulation, one consideration should be kept in mind: the addition of insulating material outside of a furnace wall will increase the temperature within the wall; should this temperature rise above the point at which the wall becomes plastic, damage may result from the weakened condition of the wall. The author cites specific applications of high-temperature insulation to blast furnaces, melting units, annealing ovens, and core and mold ovens.

OPEN HEARTH. *(See Steel.)*

Safety and Hygiene

MAGNESIUM HANDLING. *"Health Hazards in Handling Magnesium,"* Waldemar Schweisheimer, *Iron Age,* vol. 150, No. 3, July 16, 1942, pp. 56-57. Increased use of magnesium in war industry has increased the prevalence of magnesium hazards, previously almost unknown. A new kind of gas gangrene must be guarded against in open cuts and wounds from magnesium splinters and dust, a gaseous tumor being formed if the particles are not immediately and thoroughly extracted. Another condition is magnesium metal fume fever, caused by exposure to magnesium oxide generated from molten magnesium. A third form is magnesium poisoning, probably caused by inhaling magnesium oxide. Flame-proof clothing, with smooth surface and tightly woven to prevent entry of sharp particles, provides protection from these hazards as well as the practical dangers of inflammability and explosibility. In machining, large quantities of cooling agents should be employed to eliminate explosion reactions, and adequate dust exhausting facilities provided. Other precautionary measures usually associated with magnesium must also be taken.

Scrap

BRIQUETTING. *"Briquetting of Turnings and Borings,"* W. A. Phair, *Foundry Trade Journal,* vol. 69, No. 1386, March 11, 1943, pp. 205-206. The author reports the following findings of a survey of briquetting of cast iron and steel scrap in 12 foundries in the U. S.: (1) The size of briquetting die recommended by various briquetting machine manufacturers varied. Frequently the same die was used for both cast iron and steel scrap, but the resulting briquet size was not the same because of difference in the compressibility of the two materials. (2) The recommended percentage of briquets used in charges varied. Most plants agreed that approximately 50 per cent briquets was the maximum economical percentage. (3) Most plants agreed that the use of briquetting reduced their spout metal cost, but they disagreed on how much it reduced that cost.

Silicon Bronze

(See Non-Ferrous.)

Steel

BORON ALLOY. *"Effect of Boron as Alloying Element in Steel Interests Metallurgists,"* *Steel,* vol. 112, No. 11, March 15, 1943, p. 83. Extremely small amounts of boron in steel markedly increase hardenability. The maximum hardening effect is developed at 0.003+ per cent boron. As little as 0.0002 per cent boron in combination with other elements may have a distinct reaction. The effect of boron on ductility of steels varies. Small amounts may improve ductility; too much boron lowers ductility. In the past the development of boron as a hardening agent was hindered by the lack of analytical methods by which such small amounts as those used in steel could be accurately determined. Now, by calorimetric methods, boron may be accurately determined in amounts as small as 0.0002 per cent.

CARBON DETERMINATION. *(See Carbon Determination.)*

FLAME HARDENING. *"Flame Hardening,"* Stephen Smith, *Canadian Metals and Metallurgical Industries,* March 1943, pp. 24-25. The author describes a quick and economical method of simultaneously flame hardening and tempering a steel surface by passing progressively over it a unit assembly consisting of a standard multiflame oxyacetylene flame hardening tip to heat the surface above the critical temperature, a quenching jet for cooling, and a soft multiflame tip for reheating to the tempering temperature. Temperatures and degrees of hardening and tempering are all controlled and capable of being duplicated. The author describes flame hardening and tempering as it was originally applied to railroad track ends, and the manner in which simultaneous hardening and tempering is now being used on plain carbon steel replacements for manganese steel railroad frogs.

LOST WAX CASTING. *(See Lost Wax Process.)*

MOLDING SUBSTITUTES. *"Second Report of the Moulding Materials Sub-Committee of the Steel Castings Research Committee,"* *The Refractories Journal,* Jan., 1943, pp. 9-13. This report describes the attempts made in England to use substitute materials in place of bentonite binders in molding sands, and linseed oil and corn starch binders in core sands.

OPEN HEARTH REFRACTORIES. *"Acid Open Hearth Refractories,"* J. H. Chesters, *Iron Age,* vol. 149, No. 23, June 4, 1942, pp. 65-70. Refractories used in the hearth, gas and air uptakes, checkers and doors of the acid open hearth are described, also their construction and suggested lines of improvement. Present practice calls for renewal of hearths at more frequent intervals than formerly, life of 1000 heats being considered satisfactory. Metal pockets left on the hearth after tapping should be rabbled out thoroughly and dried up with silica sand. It is suggested that silica flour be incorporated in the sand used in making furnace bottoms, so that interstices between sand grains are filled with material of similar refractoriness. Principal reason for failure of acid checkers is choking, main constituent being iron oxide, other impurities being present in much smaller amounts. Blowing out dust with compressed air or steam jets frequently avoids a long shut down for checker cleaning. Main corrodant of acid furnace doors also is iron oxide. In trials with high and medium alumina fireclay brick, some 33 per cent additional life was obtained with the high alumina quality in spite of higher porosity.

OPEN-HEARTH REPAIRS. *"New Kink in Repairing Open-Hearth Bottoms,"* John D. Sawyer, *Steel,* vol. 112, No. 10, March 8, 1943, pp. 116-118, 139. The author describes a quick method for magnesite repairs on the bottoms of open-hearth steel furnaces. The hole is cleaned and filled with magnesite, and a charge of liquid slag from another furnace is dumped on

the patch to hasten setting of the magnesite. The author also briefly describes other methods of bottom repairing used in Eastern foundries.

SCRAP BRIQUETS. *(See Scrap.)*

SPECTROGRAPHIC ANALYSIS. *"The Practical Application of Spectrochemical Methods to the Analysis of Steels,"* T. L. Tippell, *Iron and Steel,* vol. 16, No. 6, February, 1943. Spectrochemical analysis is an excellent means of rapidly and quantitatively determining the elements present in steel in small proportions. The somewhat high initial cost of equipment is practically the only cost, and is soon paid for by savings in time and materials which result from use of the spectrochemical method. Equipment needed for a steelworks includes (1) a spectrograph with a means for illuminating it; (2) a light source; (3) a microphotometer for measuring the relative blackness of spectrum lines; and (4) apparatus for direct qualitative examination of the spectrum plate. The author describes the necessary equipment. The accuracy of determinations generally varies from 2 to 7 per cent of the concentration of the minor element. A complete determination of 6 elements in iron may be made in 7 or 8 minutes from the time a sample is poured.

SURFACE DEFECTS. *"Improved Surface Condition of Cast Projectiles,"* A. M. Portevin, *Metal Progress,* vol. 42, No. 2, August 1942, pp. 239-240. Casting into molds or ingots is an important and delicate operation, agitation or turbulence often having a bad effect on surface quality, extremely important in conversion into rolled and forged parts or direct use as castings. Various methods are described in pouring ingots, and their relation to splash: Top pouring, cup or bucket pouring, either separate or as a depression; protective tube sheath, bottom pouring, the Durville method of direct casting without splashing, and the reverse method of casting shells so shrink is confined to a lug attached to the base. In making cast-forged parts (casting the rough shape and giving it definite form by forging), the as-cast part must be the more perfect from the standpoint of compactness and surface quality, the less the machining tolerances. At the same time the foundry difficulties are greater because the walls are thinner and the cavity or hollow is larger and more restricted.

TRIPLEX PROCESS. *"Ford Triplexing Installation,"* W. A. Phair, *Iron Age,* vol. 151, No. 10, March 11, 1943, pp. 63-65. The author describes the production of steel by the triplexing process in a foundry operated by Ford Motor Co. Metal is melted in cupolas and desulphurized in teapot ladles. It is then transferred to side-blown converters where the carbon, manganese and silicon contents are reduced. The analyses are finally adjusted and proper temperatures built up in electric furnaces.

Steel Forgings

CAST IRON REPLACEMENTS. *(See Cast Iron.)*

Triplex Process

STEELMAKING. *(See Steel.)*

April Chapter Meeting Schedule

May 3

Central Indiana
Washington Hotel, Indianapolis
V. A. CROSBY
Climax Molybdenum Co.
"Alloys in Cast Irons and Steels"

✦

Chicago
Chicago Bar Assn. Restaurant
ROUND TABLE MEETINGS
Steel—Gating and Risering.
Gray Iron—War Changes and Their Lasting Effects on the Industry.
Malleable—Metallurgy.
Non-Ferrous—Aluminum and Magnesium.
Pattern—Cooperation of Pattern Shops, Foundries and Trade Schools.

✦

Metropolitan
Essex House, Newark, N. J.
G. H. BLACKBURN
Walworth Co.
"Making Castings Sound"

✦ ✦

May 7

Western New York
Hotel Touraine, Buffalo
J. M. SMITH
Carborundum Co.
"Super Refractories Through the Microscope"

✦

Chesapeake

✦ ✦

May 10

Cincinnati
Cincinnati Club

✦

Western Michigan
Ferry Hotel, Grand Haven

May 11

Northern Illinois-Southern Wisconsin
Beloit
E. T. KINDT
Kindt-Collins Co.
"Post-War Patterns and Pattern Engineering"

✦ ✦

May 13

Northeastern Ohio
Cleveland Club, Cleveland
ANNUAL OLD TIMERS, YOUNG TIMERS AND SOME TIMERS' NIGHT

✦

St. Louis
De Soto Hotel
R. C. TAYLOR JR.
District Priorities Mgr., W.P.B.
with RALPH McCARTY
"The Foundry's Place in the "Controlled Materials Plan"

✦ ✦

May 14

Central New York
Onondaga Hotel, Syracuse
GEO. F. PETTINOS, JR.
Geo. F. Pettinos, Inc.
"Proper Selection of Core and Molding Sands"

✦

Ontario
Royal York Hotel, Toronto
ANNUAL BUSINESS MEETING AND ENTERTAINMENT

✦

Philadelphia
Engineers Club

✦

Toledo
Hillcrest Hotel
ROUND TABLE MEETINGS

May 17

Quad City
LeClaire Hotel, Moline
CARL MORKEN
Carondelet Foundry Co.
"Castings for Ordnance Work"

✦ ✦

May 18

Twin City
ANNUAL MEETING AND STUDENT NIGHT
Moving Pictures

✦

Detroit
Rackham Educational Memorial
ROUND TABLE MEETINGS
Aluminum, Brass & Bronze, Gray Iron, Magnesium

✦ ✦

May 21

Northern California
Engineers Club, San Francisco
A. W. GREGG
Whiting Corp.
"Steel"

✦

Birmingham District

✦

Wisconsin
Hotel Schroeder, Milwaukee
ANNUAL OLD TIMERS' NIGHT

✦ ✦

May 27

Southern California
Elks Club, Los Angeles
A. W. GREGG
Whiting Corp.
"Steel"

✦ ✦

NO MEETING

Michiana
Eastern Canada-Newfoundland

✦ ✦

JUNE MEETINGS

June 19

Western New York
ANNUAL ELECTION OF OFFICERS